Growing Africa's Agriculture

KIT Royal Tropical Institute

PIATA 2019 Outcome Monitoring Report

AGRA Nigeria

Consolidated report
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Colophon

Contents

Acronyms

AGRA	Alliance for Green Revolution in Africa
ADP	Agricultural development project
AfDB	African Development Bank Group
APP	Agriculture Promotion Policy
ATA	Agriculture Transformation Agenda
ASPIRES	Agriculture Sector Policy and Institutional Reforms Strengthening project
AU	African Union
BMGF	Bill and Melinda Gates Foundation
BMZ	Federal Ministry for Economic Cooperation and Development (Germany)
CAADP	Comprehensive Africa Agriculture Development Programme
CBA	Community-based advisor
CGIAR	(formerly) Consultative Group on International Agricultural Research
DFID	Department for International Development
DUS	Distinctness, uniformity and stability
ECOWAS	Economic Community of West African States
EGS	Early generation seed
ERGP	Economic Recovery and Growth Plan
EU	European Union
FAO	Food and Agriculture Organization of the United Nations
FMARD	Federal Ministry of Agriculture and Rural Development
GDP	Gross Domestic Product
GESS	Growth Enhancement Support Scheme
GIZ	German International Cooperation
GM	Genetically modified
ICRISAT	International Crops Research Institute for the Semi-Arid Tropics
IFAD	International Fund for Agricultural Development
IFPRI	International Food Policy Research Institute
IITA	International Institute of Tropical Agriculture
ISTA	International Seed Testing Association
JSR	Joint Sector Review
KIT	Royal Tropical Institute
NAIP	National Agricultural Investment Plan
NARIs	National Agricultural Research Institutes
NASC	National Agricultural Seed Council
NCRP	National Coordinated Research Project
NCVRRC	National Crop Variety Registration and Release Committee
NESG	Nigeria Economic Summit Group
NIRSAL	Nigerian Incentive-based Risk-Sharing system for Agricultural Lending
NGN	Nigerian Naira
OPV	Open pollinated variety
PIATA	Partnership for Inclusive Agricultural Transformation in Africa
ReSAKSS	Regional Strategic Analysis and Knowledge Support System
SEEDAN	Seed Entrepreneurs Association of Nigeria
SME	Small and medium-sized enterprise

TASAI	The African Seed Access Index
UPOV	International Union for the Protection of New Varieties of Plants
USAID	United States Agency for International Development
VCU	Value for cultivation and use

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1   Summary of results

1.1   Introduction

The Alliance for Green Revolution in Africa (AGRA) aims to catalyse and sustain an inclusive agricultural transformation in Africa to increase incomes and improve food security for 30 million farming households in eleven focus countries. Since 2006, AGRA and its partners have worked across Africa to deliver proven solutions to smallholder farmers and thousands of African agricultural enterprises. The Alliance has built the systems and tools for Africa's agriculture: high quality seeds, better soil health, and access to markets and credit, coupled with stronger farmer organisations and agriculture policies. AGRA's theory of change envisages that sustainable agricultural transformation can be facilitated through a combination of:

- Policy and state capability – investments to work with and support governments to strengthen execution and coordination capacities, enhance transparency, accountability and enabling policy environment;
- Systems development – investments to build downstream delivery systems while providing support to local private sector to scale technologies and services for better productivity and incomes; and
- Partnerships – to facilitate alignment between government and private sector, improving integration and coordination for investments in agriculture.

In Nigeria, AGRA focuses on:

- Country support at state level and policy engagement
  - Support the governments of Kaduna and Niger States to translate the Green Alternative into action through improved policy formulation and implementation, enhanced coordination with agribusinesses, as well as increased budget allocations to the sector.
- System and farmer level development:
  - Facilitate public-private partnerships (PPPs) to tackle structural constraints hindering the uptake of new technologies and the creation effective agricultural systems;
  - Strengthening the capacity of farmers in Kaduna and Niger States to tap into existing and new market opportunities by increasing yield to produce surpluses and meeting quality requirements of selected market segments;
  - Enhance access to credit by financial institutions by de-risking smallholder farmers and other value chain actors.

The strategy draws heavily from lessons learned from AGRA's past investments in Nigeria. It is a five year strategy targeting 1.9 million smallholder farmers in two states (Kaduna and Niger) and costing approximately US$25 million.

For the 2019 outcome monitoring in Nigeria, AGRA decided to focus on two crops – maize and rice. For the qualitative systems review, AGRA selected the seed system and state capability and policy support.

1.2   System change

State capability and policy support

System change needs
Agricultural transformation is high on the political agenda in Nigeria, with AGRA being one of the main supporters of an enabling political and institutional environment. Various signs of progress have been registered over the past few years, including increased private sector investments in agriculture, agribusiness development and reform of the fertiliser system. Nonetheless, political commitment has not yet transpired into increased public spending on agriculture, leading to underinvestment in research and technology, rural infrastructure and public agricultural services. As a result, Nigeria was evaluated as 'not on track' with regard to CAADP commitments in the AU's 2017 progress report. Furthermore, Nigeria faces a weak enabling environment for agricultural transformation and private sector actors – including farmers – continue to encounter various barriers, such as access to land and agricultural credit, poor rural infrastructure, lack of storage and processing facilities, lack of agricultural services and high investment risks.

AGRA objectives and activities
AGRA therefore focuses on supporting the Government of Nigeria in fulfilling the country's Agriculture Promotion Policy (APP) and its accountability requirements towards the CAADP process. AGRA also directs support at the state ministries of agriculture of Kaduna State and Niger State. Specifically, AGRA has projects that aim to:
- Promote ownership of APP and the National Agricultural Investment Plan;
- Support the enabling environment through legislative advocacy (lobbying for the passage of the Fertiliser Quality Control Bill, the Nigeria Independent Warehouse Regulatory Agency Bill and the Nigeria Agricultural Seeds Council Bill);
- Strengthen the policy implementation and delivery capacity of Kaduna and Niger States to translate the APP into coordinated action;
- Promote accountability through the CAADP review process to support the Government of Nigeria in complying with the commitments of the Malabo Declaration.

Early results and analysis
Key results achieved so far include: (i) a Malabo-compliant National Agricultural Investment Plan where stakeholders were able to deliberate on its components and a detailed roadmap for implementation was established; (ii) improved policies for the seed system and fertiliser system, as two new bills were ratified by parliament through the lobby and advocacy activities of the Nigeria Economic Summit Group (NESG); and (iii) strengthened mutual accountability to meet Nigeria's progress on the CAADP commitments. At the time of research, the support to Kaduna and Niger States had just commenced and, hence, no results could yet be reported.

Through its activities and investments, AGRA has further strengthened its position as a key actor supporting the Nigerian government in its agricultural transformation ambitions. All activities are fully aligned with government priorities and correspond directly to pressing system needs. The legislative lobbying efforts are likely to result in a better regulatory framework, the planned capacity building for Kaduna State and Niger State can strengthen

policy implementation, and the emphasis on mutual accountability serve to make progress under the Malabo Declaration.

Seed system

System change needs
The seed system in Nigeria is still considered to be in its infancy. Yet, it is also a sector which is characterised by a growing and increasingly active private sector involved not only in seed certification and marketing, but also in breeding, variety release and early generation seed (EGS) production. Overall, however, funding of public research is low and a lack of IP protection for new varieties impedes enhanced private sector engagement. The supply of both EGS and certified seed is not sufficient to meet demand, but the growing establishment of outgrower schemes is a positive sign. Major bottlenecks lie in the poor distribution infrastructure and the struggling performance of agro-dealers (also confirmed by the SME survey): (quality) seeds simply fail to reach farmers. Uptake of improved varieties is medium for maize farmers (survey results: around 30%) and high for rice (survey results: 80%). For other crops, however, planting material is less readily available, there are fewer seed companies and also fewer development projects promoting adoption by farmers. Even when improved seeds are available, quality is a major concern in the face of widespread 'fake' seed and capacity gaps of the NASC which is responsible for quality control. Finally, stakeholders indicate that the seed sector is in need of improved – and updated – policies, also to align with the Economic Community of West African States (ECOWAS) Seed Regulation.

AGRA objectives and activities
AGRA's current efforts to promote seed system development focus on supporting Nigerian seed companies for increased EGS and certified seed production (maize, rice, soybean); increased seed quality control and seed sector governance through the National Agricultural Seed Council (NASC); and regulatory progress through legislative advocacy.

With regard to EGS production, AGRA supports two seed companies in Kaduna State to increase production and commercialisation of breeder seed for maize, rice and soybean. These seed companies, and two further seed companies in Niger State, are also supported to increase certified seed production. This happens in the context of the two large consortia formed by AGRA, which also work directly with farmers to promote uptake of improved seeds (see household survey).

AGRA also collaborates with the NASC to facilitate progress on seed quality control through a turnkey electronic seed certification system with scratch card authentication (labelled SEEDCODEX). The NASC is also an important partner for all other AGRA activities on seed sector development; thus receiving critical capacity development.

Finally, AGRA funds advocacy efforts to improve legislation in the seed sector, particularly to support the passage of the revised seed policy and to develop a plant variety protection law.

Early results and analysis
Efforts to promote EGS and certified seed production are well under way to meet set targets. However, the number of participating outgrowers was not clear. At the time of research, the scratch card authentication system was still in the planning phase, so no results can be

reported yet. The improved policies supported by AGRA are yet to be turned into legislation but are strongly supported and much-awaited by a variety of stakeholders.

Through its activities, AGRA addresses system needs that are pressing and not (or not fully) covered by other development partners. AGRA has therefore strengthened its position as a critical stakeholder in the seed sector and supported activities are expected to yield important results.

1.3   Household survey

A household survey was carried out amongst a group of maize farmers in Kaduna State (N=1,002) and a separate group of rice farmers (N=1,012), of which N=676 in Niger State and N=336 in Kaduna State. All farmers were sampled from farmers benefitting directly from AGRA interventions. The household survey collected data for the 2018 cropping season. Table 1 summarises AGRA outcome indicators for maize and cowpea farmers, based on the 2018 crop season. These indicators are used to measure progress at farmer level towards the AGRA goal of catalysing agricultural transformation for increased income and food security.

Table 1: AGRA outcome indicators (2018 cropping season)

Outcome indicator	Maize	Rice
Goal indicator 2: Average number of months of adequate household food provision	11.0	10.8
Goal indicator 6: Wealth assets index score	-0.320	-0.275
1. Average yield (kg/ha) (Indicator 1)	2,781	1,905
3. Rate of application of target improved technologies or management practices (Indicator 14)	99%	97%
4.4 Average distance (minutes) from farmers to agro-dealers (Indicator 15)	21.9	33.0
4. Percent of farmers accessing agricultural advisory extension support services (Indicator 16)	40%	64%
Percent of hectares under improved technologies or management practices (Indicator 20)	99%	84%
Average fertiliser use (Total N + P + K, kg/ha) (Indicator 21)	149.8	67.5
6. Percent of post-harvest losses (at farm level) (Indicator 22)	0%	1%
33. Percent of total household produce sold through structured market facilities/arrangements (Indicator 30)	5%	3%
10. Value of incremental sales as a result of AGRA (crop revenue in US$) (Indicator 36)	460.1	484.0
13. Percent farmers using financial services of formal institutions (Indicator 43)	71%	76%

Numbering according to the terms of reference. In parenthesis numbering of AGRA's Theory of Change

Maize and rice farming households have, on average, enough food to meet their family's needs during approximately 11 months of the year. Food insecurity is only experienced just before harvest time, but this does neither affect all households, nor chronic levels of food insecurity reached. The majority of households can be placed in the 2nd and 3rd wealth quintiles (out of five wealth categories). Rice farming households are slightly better off than maize farming households, but the difference is rather small. For both crops, male-headed households are, on average, wealthier than female-headed households.

The measured maize and rice yields for the 2018 season in Nigeria are high. Maize yields were calculated at 2,781 kg/ha and rice yields at 1,905 kg/ha. It is plausible to link the high yields, among others, to the use of improved varieties (41% for maize and even 78% for rice), adoption of endorsed planting practices (60% for maize, 62% for rice) and high use of endorsed fertiliser (98% for maize and 84% for rice). Access to extension services differs substantially: while only 40% of the surveyed maize farming households indicated accessing extension support, this percentage was at 64% for rice farming households.

According to farmer estimates, almost no crops are lost after harvesting. However, it should be kept in mind that post-harvest losses are typically difficult to estimate for farmers and are frequently under-reported.

The vast majority of households sell their produce on spot markets – mostly to traders/middlemen, wholesalers or retailers. Sales through structured markets arrangements are negligible for both maize and rice. Access to formal market information is also nearly absent. The value of crop sales amounts to US$460 for maize households and US$484 for rice farming households. In both cases, the value of sales is much higher for male-headed households than for female-headed households, as the former are able to sell much larger quantities due to higher production and less produce kept for home consumption.

The large majority of maize and rice farmers have access to financial services; mostly in the form of a bank account. Agricultural loans are rarely accessed, while agricultural insurance is completely absent.

1.4   SME survey

A performance survey was conducted among the 36 small and medium-sized enterprises (SMEs) that benefitted from interventions under the PIATA programme. Data was collected for seven seed companies, six agro-dealers for input supply, eight input supply companies; and ten agri-value chain companies (e.g. aggregators, traders and processors). All SMEs were rated on their performance on business resilience, financial stability, human capital, and technology/assets.

The seed companies surveyed scored well on financial stability due to good access to finance and relevant investments undertaken in infrastructure and research and development (R&D). Despite the fact that these SMEs are new enterprises, having been in business for just under four years on average, they are on a positive pathway towards good business performance. Nonetheless, there is room for improvement, especially regarding human capital and technology.

Agro-dealers have much lower business resilience due to their limited number of years in business, their focus on one service only and limited market diversification (dealing with only

two types of buyers on average). Their financial performance is relatively good in view of a solid turnover and good access to formal credit. Agro-dealers also have a solid performance on human capital, but they also only employ few employees. These types of SMEs score low on technology and have not invested much recently.

Input supply companies have the lowest score on business resilience out of the four SMEs types. This is largely grounded in the fact that these SMEs are generally new enterprises, offering only one service, on average, and interact with few different clients. Their financial performance, by contrast, is strong and they achieve a high annual turnover. Their scores on human capital and technology are rather low, indicating that these are areas for improvement.

Finally, agri-value chain companies (e.g. traders, aggregators) also have low business resilience. They have only been in business for an average of one year, but they show promise in that they seem to diversify their market risk by dealing with more than three types of buyers. So far, however, their turnover is rather low and there are shortages in human capital and technology investments.

When looking at SMEs as an important source of (rural) employment, the following results can be highlighted. Out of the four types of SMEs surveyed, seed companies have the highest number of permanent staff (49, on average) and agri-value chain companies have the highest number of casual labourers (300, on average). As expected, agro-dealers have the smallest workforce: only about 5 permanent and 3 casual staff, on average. The percentage of female employees (both permanent and casual combined) varies from 14% for input supply companies to 25% for value chain companies. Skilled labourers are particularly important for agro-dealers (37% of staff) and less important for seed companies (24% of staff).

2   Objectives and scope of the report

KIT Royal Tropical Institute was contracted by AGRA to conduct the annual outcome monitoring of its activities under the 2017-2022 Partnership for Inclusive Agricultural Transformation in Africa (PIATA).

The annual outcome monitoring has three different, interrelated objectives:
1. Understand AGRA's progress towards desired outcomes, both for internal and external reporting to (a) elicit data and insight into the effect of AGRA interventions on its beneficiaries; and (b) provide insight into sustainable improvement of the performance of agricultural sector support systems.
2. Learn about the performance of AGRA interventions, to allow for intelligent evidence-based adaptation of implementation.
3. Document lessons learned for improved design of future AGRA – and external – interventions.

These objectives were realised through a combination of quantitative and qualitative methods, implemented by a team of international and local experts. The Nigeria team consisted of:
- two international experts in quantitative data collection in agriculture;
- an international expert in qualitative data collection in agriculture;
- a national expert and coordinator of quantitative field data collection;
- a national expert in qualitative data collection in agriculture;
- a number of desk-based international analysts on quantitative data.

AGRA Nigeria selected maize and rice as priority crops for reporting. AGRA also selected the seed system and state and policy capacity as the priority domains.

Primary data was collected over a period of several weeks in mid-2019, focusing on the states of Kaduna and Niger.
- Household survey data was collected among AGRA beneficiaries. The sample was determined using multi-stage random sampling, by first randomly selecting AGRA-supported community-based advisors (CBAs), and subsequently randomly selecting beneficiaries supported by the sampled CBA. This lead to a sample consisting of 1,002 households in Kaduna for maize, 336 households in Kaduna for rice and 676 households in Niger for rice.
- Qualitative information for the systems analysis was collected by means of key informant interviews with AGRA grantees and non-involved experts across both states, focus group discussions with farmers, and an additional workshop in Abuja on the seed system.
- The SME survey was administered to 36 randomly selected companies and businesses linked to AGRA interventions.

AGRA Nigeria made available country programme roadmaps and information related to issued and planned grants. Secondary data and online reports completed the data sources.

This report should be read keeping in mind the limitations of the study. The sample size of the household data collection effort had to be capped to manage costs. Also the SME

performance survey was designed for rapid and cost effective data collection. The system analysis was limited to two systems, and field data collection was limited to one week per system.

The household data refers to the 2018 main cropping season and should be considered a baseline for monitoring future change, as AGRA-PIATA interventions had not been implemented at a scale such that significant results could be expected in the 2018 season. Similarly, the SME performance measurement will serve as a baseline for measuring change over time. The system change studies have made an effort to place the entirety of AGRA investments in a country, impacting on the system, in context. The field work, however, could, because of the limited field time, only cover a portion of AGRA's intervention portfolio.

Part I: Qualitative system analysis

3 Introduction system analysis

3.1 Agricultural policy context

Agriculture is of key importance to Nigeria's economy, contributing around 21% to GDP and employing more one third of the population (World Bank, 2019a). Nigeria's agricultural sector is not only the largest sector in the country, it also contributes 14% of Africa's agricultural GDP (PwC, 2018). Crop production accounts for 88% of total industry size, with livestock, forestry and fishing contributing 12% to the sector (PwC, 2018a). Agricultural export products include sesame seeds, cocoa, cashew nuts, ginger, soybeans and frozen shrimps and prawns.

However, agriculture's contribution to the Nigerian economy has been declining over the years due to low agricultural yields, a very low level of irrigation development, poor access to credit and markets, low use of fertiliser and other inputs, and a generally unfavourable institutional environment, including violent conflicts through terrorism. Countrywide rice yields are estimated at 2 t per ha – about half of the average achieved in Asia (PwC, 2018b). Comparable rice yields (about 1.9 t per ha) were found by the household survey conducted for the 2019 monitoring exercise (see section 8.5). Problems are also found further down in agricultural value chains, where value addition through processing has been rudimentary and consistently impeded by poor infrastructure, capacity shortages and low investment.

Agriculture contribution to Nigeria's GDP dropped by 31% from US$113.64 billion in 2013 to US$78.45 billion in 2017 (PwC, 2018a). While the country produces all basic food commodities, due to underinvestment and low productivity, it can by no means satisfy domestic demand. Achieving food security in key staples is therefore critical. For instance, despite being the largest rice producer in Africa, and despite the trade restrictions introduced by the Government of Nigeria in 2015, the country remains the largest importer of rice in Africa, importing on average about 2.6 million t per year (FAO, 2019). These food imports also result in the country having a negative agricultural trade balance, amounting to an annual trade deficit for agriculture alone of US$4.7 billion between 2016 and 2018 (PwC, 2019).

Accordingly, the country has yet to leverage on its large land resources, domestic demand for food and opportunities to export.

3.2 AGRA objectives and activities

AGRA Nigeria, 2006-2016
AGRA has been active in Nigeria since 2006 and has since invested more than US$15 million to contribute to agricultural development until 2016 (Figure 1). AGRA's focus was to strengthen public institutions with human capacities necessary to drive the technological development of the sector and adoption to improve yields, strengthen sector access to finance, while supporting private sector and other institutions to deliver services to farmers (AGRA, 2017).

Research capacity building	Research & development	Input production and distribution	Awareness creation on agriculture transformation	Adoption	Production, post-harvest and marketing
15 PhDs funded in plant breeding 5 PhDs funded in agronomy 23 MScs funded in crop science 2 MScs funded in soil science	19 varieties released 11 varieties commercialised (~57%)	6 seed companies supported 75,000 MT of seed produced 4,000 agro-dealers trained 51,000 MT inorganic fertiliser sold by agro-dealers	4,500 lead farmers trained in integrated soil fertility management (ISFM) 596 extension agents trained in ISFM 1,200 farmer organisations trained in ISFM 34 lab technicians trained in ISFM 126,000 smallholder farmers with knowledge on ISFM	100,000 smallholder farmers using ISFM technologies 61,000 ha cropped with ISFM technologies	NIRSAL Enhanced agricultural lending from 2% of overall lending in 2011 to 13% by the end of 2015 454 projects valued at over 61 billion Naira (US$300 million) guaranteed

Figure 1: AGRA investments and results in Nigeria, 2008-2016 (AGRA, 2017)

AGRA Nigeria country strategy, 2017-2021

AGRA aims to support the potential for agricultural development in Nigeria, recognising that consistent high-level interventions at federal and state level are required to deliver a broad-based economic solution (AGRA, 2019). The current strategy therefore places renewed emphasis on policy and state capability with additional investments in enhancing systems and farmer level development. Specifically, AGRA's objective is 'to increase incomes, improve food security and reduce shocks and stresses for at least 1.5 million smallholder households directly and 1.2 million indirectly in the maize, rice, soybean and cassava value chains' (AGRA, 2019). To this purpose, AGRA pursues the following objectives (AGRA, 2017):

- Country support at state level and policy engagement
  - Support the governments of Kaduna and Niger States to translate the Green Alternative into action through improved policy formulation and implementation, enhanced coordination with agribusinesses as well as increased budget allocations to the sector.
- System and farmer level development:
  - Facilitate public-private partnerships (PPPs) to tackle structural constraints hindering the uptake of new technologies and the creation effective agricultural systems;
  - Strengthening the capacity of farmers in Kaduna and Niger States to tap into existing and new market opportunities by increasing yield to produce surpluses and meeting quality requirements of selected market segments;
  - Enhance access to credit by financial institutions by de-risking smallholder farmers and other value chain actors.

The strategy draws heavily from lessons learned from AGRA's past investments in Nigeria. It is a five-year strategy targeting 1.9 million smallholder farmers in two states (Kaduna and Niger) and costing approximately US$25 million.

4   Policy and state capacity

4.1   System performance

Nigeria has been relying on revenues generated from crude oil and gas extraction since the late 1960s and political attention to agriculture has been consistently low, despite its importance for GDP growth, non-petroleum exports and employment (Inusa et al., 2018). Policy frameworks were largely incomplete, poorly implemented and unfocused (Olomola & Nwafor, 2018).

The neglect of the agricultural sector only changed under former President Jonathan, under whose administration the Agricultural Transformation Agenda (ATA) was launched in 2011. Policy goals of the ATA included integrating food production in value chains, creating incentives for private sector participation and increasing access to finance through the Nigerian Incentive-based Risk Sharing system for Agricultural Lending (NIRSAL). One of the key achievements of the ATA was the restructuring of the federal fertiliser procurement system through the Growth Enhancement Support Scheme (GESS), which provided targeted subsidies to 12-14 million farmers between 2011 and 2014 to purchase modern inputs (Olomola & Nwafor, 2018). GESS operates through an e-wallet (electronic voucher) system, which enables private sector seed and fertiliser companies to sell inputs directly to farmers through their mobile phones. This also ended the government's involvement in procurement and distribution of seed and fertilisers.

In 2016, Jonathan's successor President Buhari introduced the (also known as the Green Alternative). The APP builds on a vision of promoting an agribusiness economy to meet domestic food security goals, generate exports and support sustainable income and job growth (FMARD, 2016). The policy recognises that agricultural growth has been stymied by a lack of policy accountability and transparency, making the business environment unpredictable and discouraging to investors. The policy also acknowledges the barriers caused by weak infrastructure in the country (e.g. roads) and shortcomings in the commercialisation of new agricultural technologies by the National Agricultural Research System. As a result, the APP contains three broad themes: (i) Productivity enhancement: through access to land, access to inputs, as well as provision of efficient storage, processing and marketing facilities; (ii) crowding in private sector investment: through access to finance and agribusiness investment development; and (iii) institutional coordination of FMARD with other ministries and public bodies. The strategy has prioritised value chains for domestic consumption (e.g. rice, wheat, maize, fish, soybeans, dairy milk) and for export (e.g. cocoa, cashew, cassava, ginger, sesame, oil palm, beef).

The country's general economic development strategy, the Economic Recovery and Growth Plan (ERGP, 2017-2020) echoes the increased emphasis on agriculture to reduce the over-dependence on oil and foster economic diversification. Agribusiness is recognised as one of the six priority sectors.

Agricultural transformation is thus recognised as important at the highest levels of policymaking. Observers also note a number of positive outcomes from this political attention. With regard to private sector development, the ATA and APP have incentivised domestic and foreign investments in Nigeria's agricultural sector. In 2017, agriculture

received US$196 million of total capital inflows into the country, increased from US$23 million the previous year (PwC, 2018a). International agribusinesses such as Cargill, Monsanto and Syngenta have opened offices in Nigeria (Adebola, 2019). Tax policies have been adopted to incentivise agribusiness development, e.g. tax holidays for investors in processing plants in staple crop processing zones, higher levies on agricultural commodity and products imports to support domestic production, and zero tariffs on imports of agricultural and agro-processing equipment. The reform of the fertiliser system has also been praised, including steps to abolish the patronage networks that importers of fertilisers enjoyed through farm-input subsidies (Said & Vencatachellum, 2018) and the reactivation of fertiliser blending plants through the Presidential Fertiliser Initiative of 2016 to reduce the price of NPK fertiliser (Olomola & Nwafor, 2018). Household survey results show that fertiliser use is widespread among AGRA-supported households in Kaduna and Niger: 99% of maize-farming households and 90% of rice-farming households indicate applying fertiliser on their fields (see Sections 7.6 and 8.6).

At the same time, Nigeria is unable to meet domestic food requirements and imports large quantities of food annually, especially rice, wheat, fish and sundry items, including fresh fruits. As a result, Nigeria is not food secure. Its food import bill in 2017 was US$4.5 billion representing a 12.2% increase from the 2016 bill of US$4.01 billion (PwC, 2018a).

Underinvestment remains a challenge particularly in the public sector. While the APP recognises that Nigeria has consistently failed to achieve the targets of the Maputo Declaration and calls for 'political commitment' to increase public spending on agriculture to 10% of the federal budget, this has not yet materialised. Support for agriculture is estimated at just above 2% of total public expenditure (AU, 2018). Underinvestment affects all parts of the agri-food sector, including science and technology, rural infrastructure, availability of data and information, and agricultural services (Posthumus et al., 2019). Nigeria's level of public spending is even low when compared with many other African countries. For instance, Oxfam estimates that Nigeria allocated 2.8% of government budget to agriculture in 2015/16, compared to 11% in Mali and 10.3% in Burkina Faso (Hallum & Obeng, 2019).

As a result, Nigeria was evaluated as 'not on track' (with an overall score of 3.4/10) with regard to the CAADP commitments in the AU's 2017 progress report (AU, 2018). Also other key elements of meeting the AU's agricultural transformation objectives have not been met (Table 2).

Table 2: Nigeria's progress towards implementing the Malabo Declaration on agricultural transformation in Africa (2018)

Five key areas of strong performance		Five key areas of weak performance	
Domestic Food Price Volatility Index	5%	Public agriculture expenditure as a share of total public expenditure	2.2%
Evidence-based policies, supportive institutions and corresponding human resources	66.7%	Annual growth of the agriculture value added (agricultural GDP)	-20.7%
Men and women engaged in agriculture with access to financial services	59.6%	Increase of agricultural value added per arable land.	-20.6%

Existence of inclusive institutionalised mechanisms and platforms for mutual accountability	44%	Increase of supplied quality agriculture inputs to the total inputs requirements for agriculture commodities.	-16%
CAADP Process Completion Index	42.9%	Required data for the biennial review completed	57%

Country progress score (out of 10): 3.4 – *not on track*

Source: AU, 2018

Overall, despite political attention to agriculture, agricultural transformation continues to be constrained by limited access to credit, inputs and land, security challenges (e.g. herdsmen conflicts), infrastructure deficits and illegal food imports (Oxford Business Group, 2019). As a result, agriculture sector-based economic diversification remains elusive (Howard et al., 2019). Table 3 provides an overview of Nigeria's performance across the indicators for state and policy capability.

Table 3: State and policy capability: system indicators for Nigeria

Dimension	Indicators	Status	Narrative	Sources
1. Political commitment	Agricultural transformation is high on the political agenda		▪ President Buhari and his predecessor have voiced support for agricultural transformation: policies for agricultural sector transformation have been created since the early 2010's and agriculture receives a lot of attention. Especially food security (increased production and self-sufficiency) is high on the President's agenda. ▪ However, there is little pressure from the political economy to promote agricultural transformation due to reliance on the extractive industry; there is also a continued lack of policy implementation.	▪ Transparency International, 2019 ▪ Said & Vencatachellum, 2018 ▪ Essien, 2019 ▪ Key informant interviews
	Government expenditures on agriculture (share of agriculture in total expenditure)		▪ Nigeria is 'not on track' with regard to the implementation of CAADP commitments and government's expenditure in agriculture is approximately 2.2%. ▪ Low spending on agriculture is aggravated as release of budget is low. In 2015, only 21% of the budget was spent.	▪ AU, 2017 ▪ Key informant interviews
2. Agriculture transformation policies	Clear vision and strategy for agricultural transformation		▪ Key federal policies outline clear priorities. However, there is a lack of vision and strategic planning at the state level (only plans to meet the annual budget are made).	▪ Key informant interviews
	Policy coherence		▪ Agricultural policies have similar visions (e.g. emphasis on private sector-led agricultural development). ▪ However, a piecemeal approach to legislation in the agricultural sector leads to inefficiency within the system and in ineffective laws (e.g.	▪ Key informant interviews ▪ Smith, 2018

			National Agricultural Seed Act which runs parallel to the Crop Varieties and Livestock Breeds Act). ▪ High spending on input subsidies through the GESS impedes implementation of other agricultural policies.	
	Policy responsiveness		▪ Participatory joint sector review completed. ▪ Public research-led technology development lags far behind commitments and needs.	▪ Olomola & Nwafor, 2018 ▪ Howard et al., 2019
3. Enabling environment	Legal framework for private sector development		▪ Nigeria ranks 146/190 on the Ease of Doing Business Index 2019, scoring well on access to credit for businesses, but poorly on starting a business, getting electricity, registering property, trading across borders and paying taxes. ▪ Nigeria is ranked on 115/140 in the Global Competitiveness Index 2018, with low scores on institutions, macroeconomic stability, financial system and infrastructure; relatively higher scores on market size, product market, labour market and business dynamism.	▪ World Bank, 2019a, b, c
	Economic or regulatory incentives support private sector development		▪ APP emphasises the importance of private sector investments in agriculture. However, significant investment barriers remain, including difficult access to land and credit, and import restrictions. ▪ Lack of incentives for agribusiness to upgrade production/processing technologies; non-transparent markets with high transaction costs and high investment risks despite high (urban) demand for food. ▪ Due to taxation, farmers receive lower prices than would be the case without any policy intervention, which creates strong disincentives for farmer investments. Low incomes for farmers are confirmed by the household survey. ▪ High level of corruption prevailing in Nigeria, ranking 144/180 in the global Corruption Perception Index	▪ Howard et al., 2019 ▪ AGRA, 2017 ▪ Transparency International, 2019 ▪ Posthumus et al., 2019 ▪ Osawe, 2018 ▪ Household survey results
	Rural infrastructure		▪ Public investments in the agricultural sector are low, resulting in underdeveloped (rural) infrastructure (e.g. roads, storage facilities and processing facilities), high transport costs, very limited access to electricity and a lack of agricultural services (advisory services, access to inputs and finance). ▪ Household survey results show that only half of households indicated receiving advisory services.	▪ World Development Indicators (rural electrification) ▪ UNESCO (literacy) ▪ World Bank, 2019b ▪ Household survey results

			Furthermore, while 33% of households had access to a loan, these loans were only provided by formal financial services in 18% of cases.	
4. Implementation and delivery	Organisational structures for policy implementation and service delivery		▪ Organisational structures are largely in place but poorly functional due to underfunding and human capacity constraints. ▪ Regional geopolitical divisions between the poorer north and the more economically productive south contribute to fragility of the governance structure in Nigeria.	▪ Key informant interviews ▪ Howard et al., 2019
	Organisational capacity for implementation and service delivery		▪ Low number of extension workers (1 per 3,000-4,000 farmers), only operational through project funding. The survey results confirm farmers' low access to extension. ▪ Few states in Nigeria have the institutional capacities or resources to meet needs. Internally generated revenues are very low at state level, which creates high dependency on federal funding. ▪ State-level departments often do not function. There are no funds to carry out the work.	▪ Key informant interviews ▪ Agricultural Science and Technology Indicators ▪ Howard et al., 2019
	Mobilisation/leveraging of private sector and donor investments for implementation and service delivery		▪ Government recognises the important role of the private sector for agricultural growth; agro-industries are promoted to have inputs for farmers. Example of Presidential Fertiliser Initiative: PPP to import discounted phosphate to Nigeria and blend this with other ingredients to produce NPK fertiliser at reduced cost. ▪ Regular interaction between government and key development partners through the Agriculture Donor Working Group.	▪ Key informant interviews
5. Coordination	Different government agencies/units at national and local levels coordinate on agricultural transformation		▪ Attempt for coordination is done through the Projects Coordination Unit at FMARD. However, overlapping mandates of multiple institutional structures lead to poor implementation clarity, mixed functions between sector ministries and, implementing agencies/departments. ▪ Non-harmonisation of agricultural sector laws creates challenges with regard to their implementation. ▪ All three tiers of government are involved in agriculture but have little knowledge of each other's policies and activities.	▪ Key informant interviews ▪ AGRA, 2017 ▪ Smith, 2018
	Government coordinates with		▪ Whereas the main objective of these laws and policies is to encourage	▪ Key informant interviews

	stakeholders, including development partners and the private sector	private sector participation in the agricultural sector, government agencies still dominate all aspects of agricultural productivity making it difficult for private sector participation to thrive. ▪ Coordination with development partners is difficult as these pursue their own objectives. Especially on-the-ground coordination is challenging.	▪ Smith, 2018
6. Accountability	Policies on agricultural transformation are developed based on feedback from rural stakeholders	▪ Nigeria is making reasonable progress in adhering to mutual accountability principles and in satisfying best practices in this regard. Progress is also being made in establishing mutual accountability mechanisms and platforms. ▪ However, weaknesses persist regarding the number of areas covered by the country's joint sector review report and the establishment of inclusive institutionalised mechanisms for mutual accountability and peer review.	▪ Olomola & Nwafor, 2018
	Policies and results on agricultural transformation are published and accessible	▪ Capacity to access, understand, track and monitor budget is extremely low among farmers and other agriculture stakeholders.	▪ Ayinde, 2018
	Results-driven monitoring & evaluation of agricultural transformation	▪ In the AU 2017 progress report, Nigeria scores 66.7% in terms of promoting evidence-based policies and institutions. ▪ Weak data and lack of generally agreed monitoring indicators.	▪ AU, 2018 ▪ Olomola & Nwafor, 2018

Green: Policy commitment achieved
Amber: Significant progress made but policy commitment not yet fully implemented
Red: Bottlenecks and/or delays preventing progress on policy commitment

4.2   AGRA change ambition

AGRA's change ambition in the area of strengthening state capability is to support the Government of Nigeria in leading the agricultural transformation process as outlined in the APP. This includes a focus on the priority areas of food security, enhanced foreign exchange from agriculture, and job creation and youth employment, as well as the value chains identified as priority chains by the government. The alignment with government policy is the underlying principle of AGRA's investments.

To support agricultural transformation, AGRA aims at "working with the government [in Nigeria] to strengthen execution capacity while enhancing the transparency, accountability systems and policy environment for increased public and private sector investment in agriculture" (AGRA, 2019). AGRA considers it important to anchor the policy in institutional mechanisms with the necessary legal framework and ensure ownership at sub-national level.

Emphasising its "comparative advantage in supporting governments in building institutional capacity and creating a favourable environment for the private sector" (AGRA, 2017), AGRA

works at two distinct levels. It promotes activities at the *federal level* – for instance, to facilitate ownership of the second National Agricultural Investment Plan (NAIP) through stakeholder engagement – and at the *state level*. Support is specifically directed at the state ministries of agriculture of Kaduna and Niger States to translate the APP into action through enhanced policy formulation, monitoring and evaluation, and coordination with development partners and the private sector. AGRA emphasises that its support is targeted to areas where its investments are catalytic and can leverage investments by other partners in order to drive scale (AGRA, 2017). Investment vehicles include grants, technical assistance, consultancies, staff time and convening/meeting.

AGRA has identified five activities in the area of state capability, which correspond to the majority of the six indicators on state and policy capability.

Political commitment
[No specific objective/action.]

Agricultural transformation policies
AGRA provides support to the Government of Nigeria to promote ownership of the APP and the NAIP. Under this activity area, the following investment at federal level can be discerned:
- NAIP validation for stakeholder inclusion. AGRA supported the Federal Ministry of Agriculture and Rural Development (FMARD) to hold six regional validation workshops across the country in 2019 on the second NAIP (2017-2020 strategy). Under CAADP, every country is encouraged to have such a medium-term investment strategy in place. In Nigeria, FMARD had developed a draft strategy but the document had not yet undergone the Malabo compliance process (Olomola & Nwafor 2018). AGRA thus gave financial support to FMARD to present the draft NAIP at regional level and discuss with stakeholders, including public agencies, private sector actors, financial institutions, farmer organisations, NGOs and researchers.

Enabling environment
AGRA provides support to the enabling environment for businesses in agriculture through its project aimed at legislative advocacy can be identified:
- Legislative advocacy. Through its support to NESG in 2018/2019, AGRA lobbied for the passage of the Fertiliser Quality Control Bill, the Nigeria Independent Warehouse Regulatory Agency Bill and the Nigeria Agricultural Seeds Council Bill. This project was based on a comprehensive approach by NESG, including technical draft of legislative text, regional sensitisation workshops in eight Nigerian states to engage with farmers and value chain actors about the need for legislation, consultative visits to the relevant committees in the (federal) Parliament and creation of Public-Private Dialogue forums to convene policymakers and sector associations.

Implementation and delivery
This activity area is targeted at providing support to the two priority states of Kaduna and Niger to translate the APP into action. As several interviewees noted, the APP is not well domesticated at sub-national level, which requires support to enhance implementation mechanisms and coordinate with stakeholders, especially the private sector.
- Capacity strengthening of the Kaduna State Ministry of Agriculture and Forestry and of the Niger State Ministry of Agriculture. In these two projects, running from 2019 to 2021, AGRA offers financial and technical support to the two state ministries of

agriculture. The purpose is to enhance: (i) planning and budgeting; (ii) M&E; and (iii) sector coordination. With regard to the first topic, Synergos consultancy services has been commissioned to give training to government staff on strategic planning, mobilisation of support and implementation of plans. Training is also offered on M&E to monitor the performance of departments. In addition, AGRA financed ICT equipment for the two ministries with the purpose of establishing an e-library and data bank for policy documents, strategies and project activities and results. Finally, AGRA provides funding to coordination activities at state level and events with the private sector.

Coordination

The activities under implementation and delivery also aim to improve the coordination of national policies on agricultural transformation at state level.

The activities for stakeholder engagement and sector governance largely correspond to the activities mentioned under enabling environment and accountability, by ensuring that private sector, civil society and development partners contribute to national priorities.

Accountability

AGRA supports the Government of Nigeria to comply with its commitments in the context of the Malabo Declaration, particularly with regard to enhanced accountability through the CAADP review process. The following two investments can be identified:

- Support to the biennial review process. All AU countries are required to conduct a biennial Agriculture Review Process that involves tracking, monitoring and reporting progress made in implementing the Malabo Declaration. Nigeria participated in the first binary review process in 2018, but was only able to provide data on 19 out of 40 indicators. AGRA is now supporting the second biennial review process, which is currently ongoing. At the time of this research, data collection by FMARD was nearly complete and was awaiting validation at the end of June 2019, before the mandatory submission to ECOWAS by 30 July 2019.
- Support to joint sector review. The Joint Sector Review (JSR) serves to strengthen national monitoring, evaluation and accountability processes *vis-à-vis* stakeholders and Nigeria's progress towards the Malabo Declaration. The first JSR was conducted in September 2017, which was supported by AGRA, together with other donors, including Africa Lead, USAID and FAO. AGRA supports also the current JSR (2019 process).

In addition, AGRA invests in smaller activities, such as providing support to the Enabling the Business of Agriculture report for Nigeria and the Nigeria Agribusiness Group. An overview of AGRA's investments on state and political capability can be found in Table 4.

Table 4: AGRA Nigeria investments in state and policy capability

Region	Description/purpose of grant	Partners	Investment (US$)	Expected outcome	Timeframe	Progress to date
National	Support the development and enactment of a plant	National Agricultural Seed Council	235,470	Improved delivery high performance	Sep 2018 – Dec 2019	Secured endorsement by International Union for the Protection of

	variety protection (PVP) law			varieties to farmers		New Varieties of Plants (UPOV)
National	Turnkey electronic seed certification and traceability system for seed quality control and production and dissemination of EGS in Nigeria	National Agricultural Seed Council	1,962,390	Ensure a functional seed system	Feb 2019-Feb 2022	Agency unveiled the SEEDCODEX system to address substandard seeds in the country
National	Advocacy for the passage of the Fertiliser Quality Control Bill, the Nigeria Independent Warehouse Regulatory Agency Bill and Presidential assent of the Nigeria Seed Council Bill and its implementation.	NESG	239,582	Improve regulatory environment for fertiliser, seed and warehouse receipt system	Sep 2018 – Dec 2019	Ongoing and partially completed (Seed Council Act and Fertiliser Quality Control Act assented to at the end of 2019)
Kaduna State	Capacity strengthening to Kaduna State to enhance the ministry's capacity to set priorities, coordinate the sector and enhance execution	Ministry of Agriculture and Forestry Synergos	316,950 130,358	Improved planning, budgeting, M&E and sector governance	May 2019-May 2021	Project inception and community sensitisation
Niger State	Capacity strengthening for Niger State Ministry of Agriculture	Ministry of Agriculture and Forestry and Rural Development Synergos	303,126 242,836	Improved planning, budgeting, M&E and sector governance	May 2019-May 2021	Implementation in progress
National	Socialisation of Nigeria Agricultural Investment Plan (NAIP) in the six geopolitical zones of Nigeria	FMARD	127,175	NAIP2 Validated by stakeholders	April 2019-June 2019	Completed
National	Supporting FMARD to improve the enabling business of agriculture in Nigeria	FMARD				
National	Conduct of JSR/biennial reviews	FMARD	27,746 44,415	JSR conducted	Sep 2017-June 2019	Completed

Source: AGRA, 2019

Table 5 presents the AGRA investments according to the six dimensions of policy and state capability, which shows the choices made by AGRA and its ambition for change. AGRA focusses on supporting the Nigeria federal government with the implementation of its current agricultural policy, rather than aiming to change the current policy. An important focus of its support is to assist the Government of Nigeria in the biennial CAADP review process. In addition, a number of specific bills are being supported to contribute to an enabling

environment for agricultural production, addressing access to quality seed and fertiliser, as well as access to credit. Finally, AGRA is supporting the downstream interpretation, consultation and planning of national policy implementation by the state ministries of agriculture in Kaduna and Niger States. A clear choice has been made not to invest in direct policy implementation.

Table 5: AGRA Nigeria portfolio in different dimensions of policy and state capability

Dimension	AGRA funded action	Partners
1. **Political commitment**	▪ No particular action	
2. **Agriculture transformation policies**	▪ Support NAIP development	▪ FMARD
3. **Enabling environment**	▪ Support development of Fertiliser Quality Control Bill ▪ Support development of Agricultural Seeds Council bill ▪ Support Nigeria Independent Warehouse Regulatory Agency Bill ▪ Development and enactment of a PVP law ▪ Enabling the Business of Agriculture report	▪ NESG ▪ NASC ▪ NAG
4. **Implementation and delivery**	▪ Capacity strengthening of ministries in Niger and Kaduna State ▪ Electronic seed certification and traceability system for EGS	▪ Niger State MA ▪ Kaduna State MAF ▪ NASC
5. **Coordination**	▪ Kaduna and Niger State coordination of APP implementation ▪ Involving stakeholders in policy advocacy (development of various bills, see 3) and CAADP review (see 6)	▪ Niger State MA ▪ Kaduna State MAF
6. **Accountability**	▪ Support CAADP biennial review process ▪ Support JSR ▪ NAIP validation for stakeholder inclusion ▪ Training on M&E of ministry performance in Kaduna and Niger States	▪ FMARD ▪ Niger State MA ▪ Kaduna State MAF ▪ Synergos

4.3 AGRA system change results

Political commitment

No specific activities were undertaken to strengthen political commitment, as this is already considered to be high in Nigeria.

Agricultural transformation policies

Result: Malabo-compliant NAIP

The NAIP is a central tool for CAADP implementation as it translates the aspirations of the APP into a multi-year plan with targets, budgets and accountability. When the Ministry of Agriculture (FMARD) developed the NAIP in 2016/early 2017, they did not involve stakeholders in this process to a significant degree. As a result, the CAADP Biennial Review (2018) strongly recommended to put increased emphasis on inclusive policy dialogue to guide the development of the NAIP. AGRA therefore funded the process of stakeholder

involvement in the six geopolitical zones of Nigeria to re-open the draft NAIP and get their input.

By means of this process, stakeholders were able to deliberate on the major NAIP components and a roadmap was established, detailing deliverables and responsibilities per engaged partner. As such, Nigeria has nearly completed three out of four steps in the NAIP process, identified by the AU. It has domesticated the NAIP (involvement of stakeholders in designing the NAIP), it has identified key investment priorities for accelerating agricultural transformation, and it has formulated an evidence-based, Malabo-compliant NAIP (ReSAKSS, 2019). At the time of research, the NAIP had not yet been officially appraised and implementation was still pending.

Enabling environment

Result: improved policies for seed system and fertiliser system
AGRA invested in regulatory reform through the 10 months project by NESG. At the end of project activities in mid-2019, both the Agricultural Seeds Council Bill and the Fertiliser Quality Control Bill had been ratified by parliament and were awaiting Presidential assent at the time of research (i.e. they had not yet passed into law). The third bill which was part of the project, the Independent Warehouse bill, had not been passed by parliament.

For a discussion of the Seeds Council Bill, please see Section 5.3.

The fertiliser bill aims to improve fertiliser quality by making provisions for higher fines for product adulteration and by promoting fertiliser mixes for different soil types. It also regulates the body that manages the fertiliser system in Nigeria. Stakeholders therefore believe that the bill will improve the monitoring of sales and distribution of fertiliser. It can also enhance the profitability at various stages in the fertiliser distribution channel, protect farmers from middlemen abuses and enhance access to adequate fertiliser (Olomola & Nwafor, 2018).

The warehouse receipt bill sought to improve existing legislation. Under current legislation, stock is not bankable in Nigeria; thus, if actors hold produce in stock, they are not able to use the receipt for credit to buy from other aggregators. However, at the time of writing, the bill was not passed by parliament. NESG project managers argued that the bill touches upon various line ministries (e.g. agriculture, finance, trade, justice) and different public bodies, including the Central Bank, the Securities and Exchange Commission (SEC) and the Export Promotion Council, who all wanted to get involved. Ultimately, no consensus was reached on time. However, respondents were confident that a renewed attempt would be started to pass the bill. AGRA also continued the conversations with the Securities and Exchange Commission (SEC) to develop a guideline to back up independent warehouse activities when the Bill is passed.

Implementation and delivery

Result (expected): enhanced state capacity
The activities aimed at capacity building at state level in Kaduna and Niger States had just commenced at the time of the research; hence no results, as such, could be observed. Parts of the first training sessions had already been conducted and were well received by both ministries of agriculture. Respondents from both ministries highlighted the benefit of receiving training according to self-identified needs and priorities.

Coordination

Result: various stakeholders consulted during policy development/advocacy
The emphasis on stakeholder involvement for coordination and ownership is particularly evident in the activities under point 3 and 6.

Result (expected)
It is expected that the work with the agricultural ministries of Kaduna and Niger will contribute to coordinating the implementation of the national APP at state level.

Accountability

Result: strengthened mutual accountability
AGRA supported the first biennial review and the joint sector review of Nigeria's progress to meet CAADP commitments in 2017 (reporting period 2015-2016). This biennial review was presented to the AU in January 2018. Nigeria was among the countries not on track to achieve the Malabo commitments. Yet, because the review process was based on incomplete data, the low scoring was attributed to the fact that many of the country's activities were not captured in the existing M&E system. As such, calls were made to improve the hardware and software for data collection and management systems.

AGRA intends to continue financing the CAADP review processes for mutual accountability. The importance of financial support was acknowledged by the various stakeholders interviewed. At the same time, stakeholders expressed concern with regard to the value of conducting reviews, if these reviews are based on incomplete data and AGRA was criticised for not paying attention to this. Stakeholders argued that gaps in the review process needed to be properly identified and addressed before offering financial support in the future.

4.4   Analysis of AGRA results

AGRA's position in the intervention landscape
AGRA is clearly one of the main actors supporting the Nigerian government in its agricultural transformation ambitions. AGRA is well-known and well-connected at federal level, and has long-term partnerships with Kaduna and Niger States. It is therefore well positioned to strengthen state and political capability, which concerns AGRA's ability to identify capacity gaps and also fund projects to fill these gaps.

AGRA is aware of other relevant actors who affect current state and political capability and/or who are important to connect with in order to create or support specific initiatives. Table 6 shows how AGRA identified various stakeholders per system category.

With regard to other, potentially overlapping activities in the area of state capability, relevant projects include the assistance provided by FAO and the Feed the Future Nigeria Agricultural Policy Project:
- Under the Country Programming Framework for Nigeria 2018-2022, FAO has identified five priority areas to assist Nigeria in implementing the Economic Recovery and Growth Plan. One of the priority areas refers to "supporting appropriate and operationally effective agricultural policy and regulatory frameworks". In collaboration

with other development partners, FAO contributes to building government capacity for evidence-based policy decision-making and improved regulatory frameworks on transboundary plant and animal diseases. It appears that FAO's work is complementary to AGRA's activities.

- The Nigeria Agriculture Policy Project (2017-2021) by USAID is designed to address the need for policy research and capacity building, and to ensure that Nigerian institutions are equipped to respond effectively and in a timely manner to the increasing capacity, knowledge and information needs of FMARD. The project is a joint effort between Michigan State University (MSU) and the International Food Policy Research Institute (IFPRI)'s Nigeria Strategy Support Program (NSSP) funded by USAID-Nigeria. There is a close link between AGRA, USAID and IFPRI to reduce the risk of duplication of activities.

Table 6: AGRA's linkages with other actors in the intervention landscape

Intervention category	Sub intervention category	Development partners	Technical partners
Strategy, NAIPs & Flagships	Evidence generation & analysis	BMGF, USAID, IFAD	IFRPI/ReSAKSS, World Bank, Bureau for Food and Agricultural Policy, AGRA Agriculture Sector Policy and Institutional Reforms Strengthening (ASPIRES) project, FAO
	Technical assistance (TA) for design and implementation	BMGF, USAID, BMZ/GIZ, EU	AGRA, Africa Lead, ASPIRES, FAO
	Financing mechanisms	BMZ, DFID, Workd Bank	
Policy Reform & Implementation	Policy reform ▪ Evidence generation ▪ TA for policy reform process ▪ Policy forums & convenings	BMGF, USAID, Rockefeller Foundation, DFID, AfDB, IFAD	AGRA, FAO, World Bank, Open Forum on Agricultural Biotechnology, IFPRI/ReSAKSS, ASPIRES
	Policy translation and consolidation	BMGF, USAID, DFID	AGRA, ASPIRES, Africa Lead, FAO
Implementation Capacity	Governments ▪ Delivery units ▪ Training and capacity building ▪ TA/embedded advisor	BMGF, USAID, Rockefeller Foundation, EU	Dalberg, UNDP, AGRA, ATA, Tony Blair Institute, ASPIRES, Africa Lead, FAO
	Civil society & other non-state actors ▪ Civil society coordination ▪ Private sector coordination	BMGF, USAID	AGRA, Oxfam, TrustAfrica, Africa Lead
Sector Coordination	Donor coordination	USAID, EU, World Bank, Swedish International Development Cooperation Agency, Netherlands, BMZ/GIZ, IFAD, DFID, AfDB	Africa Lead, FAO
	Government sector coordination	USAID, BMGF, DFID	Aspires, AGRA
Accountability Mechanisms	M&E support [data and evidence investments]	USAID, BMGF, BMZ/GIZ, Rockefeller Foundation, AfDB	IFPRI/ReSAKSS, ASPIRES, AGRA, FAO
	Advocacy	BMGF, USAID	AGRA, Action Aid, Oxfam
	Accountability mechanisms [JSR, BRR]	USAID, BMGF	Africa Lead, AGRA, IFPRI/ReSAKSS, ASPIRES

Source: AGRA, 2019

Relevance of AGRA's interventions

AGRA emphasises that its activities are fully aligned with government priorities, which this study was able to confirm. The support of government policies is highly relevant, as the progress of Nigeria towards meeting the commitments of the Malabo Declaration is clearly lagging. In the 2018 Biennial Review Report, Nigeria only scored 3.4 out of 10 points and was among the countries not on track. While the government has stressed its political will for agricultural transformation, stakeholders interviewed voiced doubts in this regard and referred to the low public expenditure in agriculture. AGRA did not indicate that they worked on lobbying for a higher agricultural budget. It should also be noted that inter-sectoral competition and 'turf wars' over budget allocation are intense in Nigeria (Ayinde, 2018).

Leaving the low agricultural budget aside, several of AGRA's activities on state and political capability correspond directly to pressing needs:

1. While the APP provides an adequate framework for promoting agricultural transformation at the highest level, more detailed policies are sometimes lacking or outdated. AGRA's legislative lobbying efforts – concretely the Revised Seed Act and the Fertiliser Quality Control Act – thus contribute to a better regulatory framework required for agricultural transformation. It is unfortunate that the warehouse receipt bill was not approved, as the current legislative footing does not encourage high-quality storage of food and does not allow food storage to be used to access credit.

2. Like many other countries, Nigeria suffers from a lack of implementation of agricultural policies (Essien, 2019). AGRA addresses this in two ways. Firstly, it supported the domestication of the new NAIP, which attaches clear targets, budgets and responsibilities to the implementation of the APP. It should be noted, however, that the NAIP has not yet been formally approved and is still awaiting implementation. Secondly, in Nigeria's federal state system, implementation responsibility resides at the state level, which therefore attributes high relevance to AGRA's capacity building projects with the ministries of agriculture in Kaduna and Niger States. These states are part of the relatively heavily populated central and north-west area of Nigeria, with high illiteracy rates and high dependency on agriculture, which underlines the importance of supporting these states. Capacity gaps of other states, however, are not being addressed.

3. Mutual accountability is a critical component of the commitments under the Malabo Declaration. Supporting Nigeria in these efforts is thus clearly relevant to improve the country's progress under the Malabo Declaration.

Expected impact

AGRA's legislative advocacy efforts have borne fruit in that two important bills were passed by parliament and have received Presidential assent in 2019 (National Seed Council Act and Fertiliser Quality Control Act). While having well-crafted policy is important, implementation is a different matter altogether and lacking policy execution has been a repeated concern in Nigeria. This underlines the necessity for building the capacity and institutional structures to safeguard implementation and realise practical effects of policy support. However, this component of facilitating policy implementation has not been addressed in AGRA's legislative advocacy, as was noted by the stakeholders interviewed.

The financial support provided to FMARD to facilitate the JSR in 2017 and 2019 and for the regional validation workshops for the second NAIP in 2018/2019, together with other development partners, has been relatively small in scope but can be considered an

important factor for government engagement – an important principle underlying the CAADP process.

With regard to the support provided to the two states ministries of agriculture of Kaduna and Niger, it is too early to make any observations on effectiveness.

Sustainability of results
The strong alignment of AGRA's efforts with the agricultural transformation policies of the government is an important component to facilitate sustainability. Observers suggest that the political will of the Nigerian government to promote agriculture as an important pillar of economic growth and job creation has increased since the ATA of 2010 (e.g. Adebola, 2018; Ayinde, 2018). There are currently no signs of a change in policy, which is a positive indicator with respect to safeguarding the sustainability of AGRA's interventions.

At the same time, it should be noted that several elements of the agricultural transformation agenda continue to be politicised and can be subject to short-term political decisions. For instance, by increasingly pushing to reduce food imports, the Nigerian government reportedly urged the Central Bank to cease providing dollars to importers, despite the fact that domestic agricultural production is not (yet) able to meet domestic food demand. News commentators have pointed out the risk of increasing food prices and tensions with importing countries, especially neighbour countries/signatory countries to the African Continental Free Trade Agreement.

5 Seed system in Nigeria

5.1 System performance

The APP encourages private sector investment in agro-input supply, including seed production and multiplication. At the same time, the seed sector in Nigeria remains an infant industry (FMARD, 2015). This shows, for example, in the fact that production of certified seeds is estimated at less than one quarter of national demand, according to NASC – despite the fact that the number of registered seed companies has risen from 11 in 2011 to 314 in 2019. Recent strides have been made to improve the seed sector, but gaps remain.

There are four seed sub-systems in Nigeria, namely: (i) farmer-saved seed systems; (ii) public-private systems composed of the National Agriculture Research Institutes (NARIs) with private seed company involvement in certified seed production; (iii) public-led systems; and (iv) private-led systems dominated by local seed companies (USAID, 2016). The farmer-saved seed sub-system represents the majority of seed volume and an estimated 80% of the Nigerian farming population depends on farm-saved seed (Oyekale, 2014). The largest proportion of the EGS volume, both breeder and foundation seed, is produced by public and private systems, while farmer-saved seeds and farmer-to-farmer seed exchange dominate the informal seed sector (USAID, 2016).

The strengths and weaknesses, and priorities for improvement of the seed system in Nigeria are listed in Table 8.

Variety development
Traditionally, the six NARIs – one for each major agro-ecological zone – are tasked with variety development in Nigeria. They have a total of 19 active breeders (Waithaka et al., 2019). Different CGIAR centres are also active in variety development, especially the International Institute of Tropical Agriculture (IITA), the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), and AfricaRice. Reduced investment in public-sector plant breeding, combined with cut-backs in international agricultural research organisations, has been observed due to inadequate funding of the NARIs (USAID, 2016).

Unlike many countries in West Africa, the private sector plays an important role in variety development since public domination was ended in 2000 and private actors were included on the list of actors qualified to develop new varieties for registration and release. Nigeria-based Value Seeds even tops the international Access to Seeds Index 2019 ranking in new research on seed in Western and Central Africa. According to Waithaka et al. (2019), there are four private sector breeders active in Nigeria. By now, the private sector constitutes 13% of variety releases in the country, with public research, including CGIAR centres, accounting for the remaining 87% (Access to Seeds Index, 2019).

To register a variety, trials need to be conducted to proof the distinctness, uniformity and stability (DUS) and the value for cultivation and use (VCU) of the proposed variety. Variety registration requires two seasons of multi-location trials for DUS and VCU testing, followed by two seasons of on-farm trials, of which data needs to be submitted to the National Variety Release Committee (NVRC). According to the World Banks' Enabling the Business of Agriculture Report 2017, it takes, on average, 367 days to release a new maize variety in

Nigeria, which seems rather fast; for crops like cassava and yam, the time required is reportedly twice as long (World Bank, 2017). The African Seed Access Index (TASAI) mentions an average duration of variety release of 43 months (Waithaka et al., 2019), which seems more accurate, considering the total of four seasons of testing required.

EGS production

The NARIs are also responsible for breeder seed and foundation seed production (pre-basic and basic seed). This includes the mandates to distribute breeder seed free of charge and to ensure that genetic purity of varieties that have originated from their institutes is maintained. The NARIs are supported by the three CGIAR centres (IITA, ICRISAT and AfricaRice).

Private seed companies also produce foundation seed based on breeder seed from research institutes, although at a relatively limited scale due to high production costs, as due to a lack in technical expertise and regulatory barriers, such as import restrictions on EGS. Private companies wanting to produce both foundation seed and certified seeds also have to do so under separate trade names, registered with the NASC.

Overall, EGS production in Nigeria suffers from insufficient funding of public research and low breeder seed output, lack of capacity of SME seed companies and high investment barriers for the private sector (USAID, 2016). Most seed companies are reportedly reluctant to invest in production capacity to generate own breeder and foundation seed, as it takes a long time to realise results (NESG, 2019a). Waithaka et al. (2019) report that two multi-national seed companies operating in Nigeria produce their own EGS. In spite of difficulties, the overall availability of foundation seed is judged to be 'good' by Nigerian seed companies, even though they indicate not always obtaining the varieties they want in the desired quantities, and recommending a better collaboration to forecast demand (Waithaka et al., 2019).

Seed multiplication

According to the NASC, companies registered to produce certified seed in Nigeria increased from 11 in 2011 to 314 in 2019. The majority are SMEs that produce fewer than 1,000 MT of seeds annually. Their business performance is often still fragile but promising with a good outloook, as the SME survey shows (see Section 9). The substantial growth in the number of commercial seed companies is, among others, attributed to AGRA's previous Programme for Africa's Seed Systems (PASS, 2007-2016). Seventy-two (72) of the registered seed companies are members of the private sector association SEEDAN. Of all the registered companies, only about 50 are believed to be active in certified seed production. Most registered seed companies are only involved in sales and do not produce any certified seeds. One of the reasons for this is that many seed companies are SMEs with limited working capital to invest in the necessary infrastructure for seed processing (NESG, 2019a). However, among the SMEs assessed as part of this study, seed companies perform relatively well in the fields of financial sustainability and technology. The results show room for improvement on business resilience and human capital (see Section 9.3.1).

Out of the 24 companies registered in Nigeria included in the 2019 Access to Seeds Index, only six of them are engaged in seed production and processing. Four of these companies also have breeding activities in the country. Seed multiplication by companies is generally done through outgrower schemes, in addition to company-owned multiplication fields.

In addition to private seed companies, government-owned agricultural development programmes (ADPs) have been key actors involved in commercial seed production. These projects, starting from the 1970s onward, have been designed to increase crop production through improved technology, including seeds. Much of the seed multiplication under these projects has happened through the services of contract growers and existing private seed companies (Oyekale, 2014). While the ADPs depend on donor funding and are thought to be irregular seed producers and suppliers, they are still considered to create unfair competition and a source of market distortion by private seed companies that need to sell their seed at regular market prices (NESG, 2019a).

Community-based seed production, as a semi-formal system, also exists in Nigeria. In this system, individuals, farmer groups or producer cooperatives produce and market seeds which are inspected by the NASC, but cannot be certified as the seed producers do not fulfil all necessary requirements to be registered seed producers. These community-based seed producers market their seed to members of their groups and other farmers within and around their communities.

Seed marketing and distribution

Only registered seed companies and dealers are licensed to market seeds commercially in Nigeria. Small-scale farmers are not allowed to sell their farm-saved seeds and varieties, except if they are registered as a licensed seed producer or if they engage in barter or non-commercial activities (Adebola, 2018).

The poor seed distribution network across all geopolitical zones of Nigeria is a recognised problem. While seed companies have increasing experience in seed production and urban sales, they lack the distribution channels and marketing expertise to grow and maintain rural retail outlets, while also stimulating farmer demand (AGRA, 2017). At the same time, stakeholders consulted stated that because government has been a major outlet for certified seeds, especially during the ATA, there have been few incentives for companies to develop their own market.

Agro-dealers are the most important distributors of open-pollinated varieties (OPVs) and hybrid seeds, but their networks are few and do not reach deep into rural areas (USAID, 2106). The SME survey conducted as part of this research confirms that agro-dealers face major challenges, particularly with regard to business resilience and financial sustainability (see Section 9.3.2). Poor rural infrastructure, including feeder roads, storage and electricity, aggravate the shortage in seed distribution. As a result, many farmers do not have access to improved seeds – or, in case they do, they are at risk of being exploited in the absence of market competition (Oyekale, 2014).

International trade in seed is virtually absent in Nigeria. Except for inbred lines and new varieties for seed development purposes, importation of large quantities of seed is subjected to multi-locational trials by officials of the National Coordinated Research Project (NESG, 2019a). According to NASC, seed trade is inhibited by cumbersome existing import regulations and the absence of a plant variety protection law in the country. This contributes to the problems of certified seed shortages in Nigeria (NESG, 2019a).

Seed use

According to USAID (2016), smallholder farmers in Nigeria are well aware of improved varieties. However, adoption is still relatively low (Waithaka, 2019) and the majority of

farmers use recycled seeds of landraces, either from their own farm or bought at the local market. This is largely attributable to the perceived high prices charged for high quality seed improved seed varieties, even though TASAI (Waithaka, 2019) indicates that maize hybrid seed is the lowest in Nigeria for all countries covered. Adoption of improved seeds is therefore often linked to free access through ADPs, donor or NGO projects.

At the same time, uptake of improved seeds is higher for some crops than for others. For instance, a USAID report from 2016 estimates that 50% of the maize planted area is supported by the formal seed system, but only 10% of the rice area is planted with seeds sourced from the formal system (USAID, 2016). In maize, the high adoption rates are linked to the release of hybrid varieties, which, in turn, is connected to the presence of several maize-focused NGO and donor development initiatives (USAID, 2016). For other crops, planting material is less readily available, there are fewer seed companies engaging as the business case is less attractive, and also fewer development projects promote the use of quality seed. Accordingly, there has been little demand for, or development of, root and tuber varieties (Kuhlmann et al., 2019). The low number of extension agents that could promote the use of high quality seed of improved varieties is considered a further hindrance to increased farmer uptake (NESG, 2019a). Household survey results are partly in line with this. The data shows that 50% of households in our sample indicated having used recycled seeds last season. About one third of the sample used hybrid maize seeds (see Section 7.6). Rice farmers, on the other hand, cultivated improved varieties in 80% of cases (see Section 8.6).

Seed quality control
NASC is responsible for seed certification and quality control, including licensing of all companies engaged in variety development, EGS production, seed multiplication and marketing. NASC employs a total of 50 seed inspectors to cover the entire country, while no system of accredited private inspectors exists.

The quality of improved seeds remains a key concern in Nigeria. There is mention of widespread tampering with seed certificates and sales of counterfeit seeds. The lack of strong sanctions by public authorities is often mentioned as a cause of the proliferation of fake seeds (USAID, 2016).

On the other hand, poor storage and handling by agro-dealers and other companies involved in marketing of seeds has been identified as a source of poor quality seed. Many agro-dealers are not well trained and store seeds under poor (i.e. humid and hot) conditions, which makes seeds unviable. This, in turn, also contributes to scaring off farmers and reducing demand for improved seeds.

Seed policies and governance
Initially, development of the seed industry was under the mandate of FMARD, which was changed in 1975 and sector governance was taken up by the predecessor of NASC. The latter was founded in 2009, which implies that NASC is the regulatory body for seed testing, registration, release, quality control, and supply and use of seed, as well as the development of regulations concerning quarantine measures, importation, and exportation of seed, among others.

The APP recognises the importance of providing a conducive legislative framework (see Section 4.1), including improving the functioning of NASC and facilitating the passage of the

pending seed bill in the national assembly. It also encourages facilitating a shift in leadership in the commercial aspects of the seed industry to the private sector and the need for a strong government role in the provision of support services for the seed sector (Kuhlman et al., 2019). Nigeria also committed to reforming its seed laws as part of its membership in the G8 New Alliance for Food Security and Nutrition. Finally, the Nigerian government recently adopted a multi-year seed sector road map, developed through a consultative process as a partnership between FMARD and the Netherlands Embassy in Abuja. The sector road map serves as a strategic and policy document to guided stakeholders to work towards an increase in farmers' access to and use of quality seed of improved varieties (NASC & SEEDAN, 2020).

While the revision of the seed law and the seed sector road map are positively shaping the seed industry in the country, a number of other regulatory shortcomings were highlighted by stakeholders interviewed. First and foremost, there is no plant variety protection law currently operational in Nigeria. Although the country has signed various treaties of FAO and the Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS), plant varieties are not fully protected. In the absence of a plant variety protection system, private companies are granted a moratorium for a 10-year period to market the new varieties, after which the varieties enter into the public domain (Adebola, 2018). Despite the moratorium, the lack of variety protection acts as a barrier to private variety development and private seed companies currently produce EGS solely based on publicly released varieties. Work is ongoing to develop a model plant variety law that will be in line with the UPOV 1991 convention (Access to Seeds Index, 2019).

Furthermore, Nigeria's local seed law is not yet aligned with ECOWAS Seed Regulation, which covers key crops for food security and regional trade. This impedes regional sales of seed, even in the face of acute shortages (NESG, 2019a). Many of the crop varieties registered in Nigeria have not yet been incorporated into the ECOWAS Regional Catalogue, which prohibits any cross-border trading in the region.

Nigeria does have a biosafety agency law, which is considered a fast-track for commercialisation of genetically modified (GM) crops, and confined testing of GM crops is currently underway (Access to Seeds Index, 2019).

Table 7: Legal architecture for plant varieties in Nigeria

Laws and regulation	Coverage
Patents and Designs Act 1970	Prohibition of patents for plant varieties
National Crop Varieties and Livestock Breeds (Registration, etc.) Act 1987	Register for the certification, registration and release of national crop varieties and livestock breeds
National Agricultural Seed Decree 1992 (replaced by National Agricultural Seeds Act Cap. N5 LFN 2004)	Commercialisation of plant varieties; establishment of the NASC
National Environmental (Access to Genetic Resources and Benefit Sharing) Regulation 2009	Access and benefit sharing (not operational)

National Biosafety Management Agency Act 2015	Establishment of National Biosafety Management Agency as national authority responsible for regulatory framework on biotechnology
NACGRAB Guidelines for Registration and Release of New Crop Varieties in Nigeria, 2016	Enhanced process of variety release
2017 NASC Guidelines for Registration of Seed Producers or Companies and Seed Fields in Nigeria	Enhanced process of seed company registration and quality control
National Agricultural Seeds Council Bill 2019	Improved provisions for the seed sector, including seed registration and certification, plant variety protection, production, sales and trade

Source: Adebola, 2018; Kuhlmann et al., 2019; stakeholder interviews

Table 8: Overview of the seed system in Nigeria

	Actors	Strengths	Weaknesses	Improvement
Variety development	• NARIs • CGIAR institutes • Seed companies • National Crop Variety Registration and Release Committee • National Centre for Genetic Resources and Biotechnology	• Relatively high number of private companies active in variety release compared to other West African countries • Reduced time for variety release compared to previous years	• Lack of Intellectual Property (IP) protection and thus no incentives for variety development • Theft of patents • Slow release of improved varieties • Low funding of NARIs	• Enactment of patent law • Recruitment and training of young breeders • Improve NARIs' capacity to perform *Priority: medium (3)*
EGS production	• NARIs • CGIAR institutes • Seed companies with license to produce EGS	• Private sector now has license to produce EGS • Free breeder seed from public research • Small but growing number of private companies involved in EGS production	• Low EGS output of NARIs • Low funding of NARIs • Low technical capacities and inadequate infrastructure of EGS producers • Lack of adequate EGS demand forecasting needed to inform suppliers • Lack of credit for private EGS producers	• Support from government and development partners for capacity building of EGS producers • Recruitment and training of young breeders *Priority: very high (1)*
Seed multiplication	• Seed companies • Outgrowers • Farmers • Community-based seed production schemes • Development partners • Agricultural development programmes	• Supply of certified seeds has increased substantially with emergence of private seed companies • Outgrower schemes for seed multiplication well established	• Relatively low profitability of seed multiplication • High staff turnover rate at seed companies • Poor seed processing facilities • Focus on maize hybrids and OPVs; low certified seed production of other	• Support from government and development partners for capacity building of seed producers • Processing infrastructure needs to be improved, e.g. through access

			food crops (e.g. cassava, millet)	to credit for investors • Improved support for community-based seed production *Priority: high (2)*
Seed marketing & distribution	• Seed companies • Local market distributors, e.g. agro-dealers • NGOs • Development partners • Agricultural development programmes	(no strengths identified)	• Poor distribution network of seed companies failing to reach farmers • Few sales outlets • Poor rural infrastructure • Inadequate agro-dealers, including poor handling of seeds • Weak partnership between seed companies and agro-dealers • Limited number of extension workers • Lack of international trade (no export of seeds)	• Improve agro-dealers' capacity to handle seeds and advise farmers on seeds • Support seed companies to enhance marketing in rural areas *Priority: very high (1)*
Seed use	• Farmers • Extension agents • NGOs • Development partners • Agricultural development programmes	• Increased demand for certified seeds for cereal crops, especially maize, rice and sorghum	• Reliance on farm-saved seeds and low adoption of improved seeds • Lack of demonstration trials to educate farmers about the benefits of improved varieties • Poor agricultural practices • High costs of hybrid seed • Use of poor-quality seed due to adulteration, which results in farmers' scepticism about improved seeds	• Capacity building for extension agents • Strengthen regulatory agencies to ensure quality of seeds and create outreach to farmers • Support community-based seed production as a means to improve quality of farm-saved seeds *Priority: medium (3)*
Seed quality control	• NASC • National Seed Service Unit • Seeds Standards Committee • Seed companies	• Quality control regulated through one single organisation (NASC) • Activities of NASC spread over all 36 states • Trained personnel	• Insufficient trained NASC personnel to inspect and certify seed production fields • Inadequate/ understaffed laboratories for quality control	• E-certification system and labelling of seeds • Enhance inspection frequency of seed companies and EGS

			Funding challenges • Widespread presence of counterfeit seeds	producers by NASC • Increase funding to NASC • Outsourcing of seed inspection to private third parties (with accreditation) *Priority: high (2)*
Seed policy & regulation	• FMARD • NASC • National Assembly • UPOV • ISTA • OECD • ECOWAS • Development partners	• Strong synergies and partnership between some agencies • New seed bill 2019	• Unclear policies and regulations governing seed imports • Slow pace of legislative process • Lack of harmonisation with ECOWAS regional seed agreement	• Continued advocacy to strengthen political will • Harmonisation with ECOWAS regulation *Priority: very high (1)*
Sector governance	• NASC • FMARD • SEEDAN • National Programme on Food Security	• Revision of seed bill supported by broad coalition of national actors and development partners • Agreement on the importance of NASC	• NASC activities have been grounded due to weak funding mechanism • Inadequate implementation and enforcement • Poor coordination between actors	• Enhanced stakeholder coordination *Priority: medium (3)*

Sources: USAID, 2016; NESG, 2019a; stakeholder workshop 2019
Note: Priority for improvement based on stakeholder workshop 2019, estimated on a scale of 1 (very high) to 5 (very low) priority.

5.2 AGRA change ambition

AGRA Nigeria pursues systems' development by means of "building downstream delivery systems closer to smallholder farmers while providing support to local private sector to scale technologies and services which deliver better productivity and incomes" (AGRA, 2019).

AGRA has been supporting seed companies in Nigeria since 2006. Initially, this was focused on technical support and subsequently also financial support for existing seed companies, i.e. those that were already registered and had been engaged in seed production activities. However, over time AGRA came to realise that there were continued barriers in the seed sector, including slow release of new varieties from the research side, quality concerns of improved seeds, low adoption of new varieties at the farmers' end and different policy constraints. These barriers blocked progress to create a viable seed sector, with active private sector engagement. Under the PIATA programme, AGRA Nigeria therefore aims at seed system development, with a particular focus on EGS production, seed quality and seed policy. Table 9 and Table 10 provide an overview of AGRA's projects in the seed system.

Variety development
There are no AGRA activities under the PIATA programme to support variety development.

EGS production

In its project 'Increasing Production and Dissemination of Quality Early Generation Seed to Improve Income and Food Security of Farmers in Nigeria', with a total volume of around US$2 million, AGRA is working with NASC and two seed companies in Kaduna State – Premier Seeds and Value Seeds – to increase breeder seed production. While the support to NASC serves to ensure a better regulation of seed companies, as well as provide support for the available EGS, the activities with the two companies aim to increase production and commercialisation of breeder seed. Premier Seeds and Value Seeds were selected based on their capacity to produce breeder and foundation seeds. Under the project, the targeted three crops are maize (700 MT), rice (650 MT) and soybean (460 MT). In addition to funding, AGRA provides technical assistance to both companies to produce breeder seed and also arranged for special permission from NASC so that the companies can produce and sell EGS and certified seed under the same company name. The mandate is to produce breeder seed for the whole country.

Seed multiplication

Certified seed production is a key component of the Niger Consortium and the Kaduna Consortium formed by AGRA.[1] In Niger, the focus lies on rice, in collaboration with Tecni Seeds and Da All Green Seeds. In Kaduna, the consortium works on maize, rice and soybean value chains, but certified seed production by Premier Seeds and Value Seeds is confined to maize. In both consortia, AGRA provides financial and technical support to the companies to ensure that certified seed production corresponds to the demanded quality requirements. Most of the certified seed production of the participating companies is conducted by outgrower farmers, with very little in-house farming capacity (e.g. Premier Seeds: nearly 100% outgrower based; Value Seeds: approximately 95% outgrower based). The choice of certified seed production is determined by farmer demand.

Seed marketing and distribution

AGRA does not work directly on distribution and considers this as part of the responsibility of seed companies, as an AGRA programme officer reported during an interview. At the same time, AGRA encourages partnerships between seed companies and agro-dealers for improved distribution channels in the context of the Kaduna and Niger consortia. However, at the time of this research, AGRA communicated that the partnerships between agro-dealers and seed companies do not seem to work due to disagreements on the funding arrangements. Agro-dealers requested companies to deposit seed stock for them to sell and then repay the seed companies, whereas seed companies insisted that agro-dealers buy the seed stock and pay directly. These disagreements have stymied the attempts for partnership and AGRA staff recognised that a hands-off facilitating approach does not seem to work. AGRA was therefore reconsidering its strategy at the time of the research.

The work of the Kaduna consortia on upgrading village-based advisors as rural sales agents seems to be more important for the distribution of improved seeds. By linking village-based advisors with agro-dealers, the idea is that they can provide farmers with improved seeds and also train farmers on the use of these seeds.

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[1] In addition to seed production and promotion, these consortia work on issues of extension and agricultural advisory services through the development of a village-based advisor network, farmer aggregation and collective marketing, and the development and provision of crop and site-specific fertiliser blends. Members of the consortia include Sasakawa Global 2000, Value Seeds (only Kaduna), Premier Seeds (only Kaduna), Da All Green Seeds (only Niger), Tecni Seeds (only Niger), AfricaRice, AFEX Commodities Exchange, National Agricultural Extension Research Liaison Services, Institute of Agricultural Research, and Fertiliser Producers & Suppliers Association of Nigeria

Seed use

Part of the consortium activities in Kaduna and Niger entails the establishment of demonstration plots ('mother and baby demos') for selected seed varieties to train farmers on the use of improved seeds and good agricultural practices. During field days, the four seed companies involved also provide small packs (100 g of seed) to farmers to create awareness and let farmers experiment with improved seeds on their own farms.

Seed quality control

Through its support to NASC, together with USAID Nigeria, AGRA aims to address the widespread proliferation of counterfeit seeds through a turnkey electronic seed certification system with scratch card authentication (labelled SEEDCODEX). Under this scheme, farmers are supposed to be able to verify the certification status – and the seed producer – of seed packets they purchase from agro-dealers. The provision of scratch card authentication is intended to be coupled with an e-verification system through barcode scanning with smartphones or, alternatively, through an SMS-based verification service. According to NASC, this should make it impossible for the faking of any seed certified by the NASC, and will give NASC control over every certification tag throughout the entire seeds value chain. This project started in 2019 and, in May this year, a letter of intent was signed with a partnership with mPedigree Network Nigeria to develop the technology platform.

Seed policies and governance

Support to NASC. To strengthen the role of NASC in Nigeria's seed sector, AGRA implements all its national level seed activities with and through the NASC (see Table 9).

Support to the passage of the revised seed policy. The National Seeds Act of 2004 had undergone review under technical guidance of FAO and through the review of the subsisting seed policy and consultative workshops with various stakeholders including farmers, seed producers and policymakers (FAO, 2016). AGRA supported the passage of this bill through partnership with NESG.

Development of plant variety protection law. AGRA supports the development of a plant variety protection law by means of a grant to NASC. Development of this law takes place in collaboration with UPOV. Different stakeholder meetings have been held to create buy-in of seed actors, emphasising the importance of such a law in securing varieties of high-performance seeds for Nigeria's agricultural transformation.

Table 9: AGRA Nigeria investments in seed system development

Region	Description/purpose of grant	partners	Investment (US$)	Expected outcome	Timeframe	Progress to date
National	Support the development and enactment of a plant variety protection (PVP) law	NASC	235,470	Protection of IP to promote private sector engagement in high performance variety development	Sep 2018 – Dec 2019	Secured endorsement by UPOV
National	Turnkey electronic seed certification and	NASC	1,962,390	Improved quality control	2019	Contract with technical

	traceability system for seed quality control and production and dissemination of EGS in Nigeria			and eradication of counterfeit seeds		partner (mPedigree Network Nigeria); technology under development
National	Advocacy for the passage of the Fertiliser Quality Control Bill, the Nigeria Independent Warehouse Regulatory Agency Bill and Presidential assent of the Nigeria Seed Council Bill and its implementation.	NESG	239,582	Improve regulatory environment for fertiliser, seed and warehouse receipt system	Oct 2018 – July 2019	Partially completed
Kaduna	Increasing production and dissemination of quality EGS to improve income and food security of farmers in Nigeria	Premier Seeds Nigeria Limited	458,636	Quality EGS production	Feb 2019 – Feb 2022	Project activities have started
National	Increasing production and dissemination of quality EGS to improve income and food security of farmers in Nigeria	NASC	1,027,414	Quality EGS production	Feb 2019 – Feb 2022	Project activities have started
Kaduna	Increasing production and dissemination of quality EGS to improve income and food security of farmers in Nigeria	Value Seeds Limited	476,340	Quality EGS production	Feb 2019 – Feb 2022	Project activities have started
Niger	Increasing rice productivity to improve income and food security of farmers in Niger State, North-Central Nigeria (Niger Consortium)	Da-All Green Seeds Limited	166,801	Foundation seeds production, certified seeds	Apr 2018 – Mar 2021	Project activities have started
Niger	Increasing rice productivity to improve income and food security of farmers in Niger State, North-Central Nigeria (Niger Consortium)	Tecni Seeds Limited	166,827	Certified seed production	Apr 2018 – Mar 2021	Project activities have started
Kaduna	Uplifting smallholder farmers' livelihood in Kaduna State of Nigeria through market driven upscaling of the maize, rice and soybean value chains (Kaduna Consortium)	Premier Seed Nigeria Limited	235,472	Certified seed production	Apr 2018 – Mar 2021	Project activities have started
	Uplifting smallholder farmers' livelihood in Kaduna State of Nigeria through market driven	Value Seeds	171,750	Certified seed production	Apr 2018 – Mar 2021	Project activities have started

			53,453		
	upscaling of the maize, rice and soybean value chains (Kaduna Consortium)				
National	Korea-AFRICA rice development network for enhancement of high yielding rice germplasm and breeding capacity	University of Port Harcourt	53,453	Establishment of rice development network	Completed

Table 10: AGRA-PIATA-funded activities per seed sector component

Envisioned change	AGRA activity	Timeline	Scope and scale	Implementing partners
Variety development	No activities under PIATA			
EGS production	Improve quality assurance by NASC Support development of private sector breeder and foundation seed production	2019-2022	Production Kaduna and Niger State Ambition: national	NASC Premier Seeds Value Seeds Da-All Green Seeds
Seed multiplication	Support commercial certified seed production linked to customer demand	2019-2022	Kaduna State – maize Niger State – rice	Niger and Kaduna State PIATA consortia Private seed companies
Seed marketing and distribution	Facilitate linkages between agro-dealers and seed companies Pilot seed sales through VBAs in Kaduna	2018-2021	Kaduna and Niger States	Premier Seeds Value Seeds Da-All Green Seeds Tecni Seeds
Seed use	Promote the use of quality seed through widespread demo's and small seed packs	2018-2021	Kaduna and Niger States	CNFA
Seed quality control	Support NASC to improve its quality assurance performance Development of scratch-card based traceability system (SEEDCODEX)	2019-2022 2019	National	NASC, mPedigree Network Nigeria
Seed policy and regulation	Support Nigeria Seed Council bill Presidential assent and its implementation Support development PVP law	2018-2019		NASC, NESG

5.3   AGRA system change results

EGS production

In the Kaduna consortium, 256 MT of EGS were produced in 2018 out of a target of 454 MT. For the Niger consortium, no numbers were available on achieved EGS production. However, it was mentioned that one of the two involved companies had established EGS outgrower schemes of 2 ha in Shiroro and 4 ha in Bida.

Seed multiplication

In the Kaduna consortium, 14,883 MT of certified seed were produced in 2018 out of a target of 35,350 MT. For the Niger consortium, no numbers were available on achieved certified seed production.

Seed quality control

There are plans to deploy an electronic authentication system to tackle the problem of adulterated seeds in Nigeria's agricultural sector. At the time of research, the activities on this had not yet started.

Seed policies and governance

Agricultural Seeds Council Bill

The Agricultural Seeds Council Bill was signed into law by President Buhari in mid-2019, replacing the National Agricultural Seeds Act of 2004. Interviewed stakeholders expect that the new legislation will improve the availability and affordability of quality seeds to smallholder farmers by encouraging investments in seed production and enabling the private sector to perform its expected functions of meeting quality seed requirements by farmers (see also Olomola & Nwafor, 2018). The bill also penalises the sale of adulterated seeds to address the widespread problem of counterfeit seeds, which is supposed to protect farmers from poor quality seeds. Finally, the seed bill improves the oversight function of the NASC, making it the principal institution responsible for the administration and implementation of National Seed Policy, including market regulation and quality control of the seed industry. It will also be tasked with the facilitation of the production and distribution of sufficient quantities of high-quality seed of improved varieties of all relevant crops to farmers.

Expected benefits of the new seed bill according to NASC:
More private sector investment;
- Being on par with global best practices;
- Reduced fake seeds due to stiffer penalties;
- More quality control;
- Development of third party certification with accreditation at NASC;
- Harmonisation with ECOWAS variety release system;
- Reducing total number of years for trial until release from 4 to 2 years.
Source: Interview with NASC

Plant variety protection

The new Seeds Council Bill also makes a provision on plant variety protection: "The Minister shall promote policies and strategies to foster registration of new plant varieties and protection of farmers' rights" (NESG, 2019). AGRA supports a draft law on this matter to provide legal intellectual property rights to plant breeders who develop new and improved seeds for increased crop production, developed in collaboration with the NASC and UPOV. Nigeria's Federal Ministry of Justice is currently reviewing the draft law for possible adoption. Meanwhile, NASC has applied for UPOV membership. While stakeholders interviewed were positive about the envisaged plant varieties protection act, there is also criticism. Adebola (2018), for instance, argues that the UPOV system is unsuited to Nigeria's small-scale centred agricultural sector, as the required strict compliance with UPOV's plant breeder's

rights system prohibits the inclusion of alternative conditions for breeder's rights. This marginalises farmers' varieties, which are genetically variable.

5.4   Analysis of AGRA results

AGRA's position in the intervention landscape

The seed sector in Nigeria is supported by a variety of development partners. Interventions on seed system development include the following projects:

- The IFAD-funded Value Chain Development Programme in Nigeria assists cassava and rice smallholder farmers through a value chain approach to enhance productivity, promote agro-processing and increased access to markets. This approach seems to be well aligned with AGRA's rice value chain development in Niger State.
- GIZ's Competitive African Rice Initiative (CARI) (2013-2021), co-financed by Bill and Melinda Gates Foundation (BMGF) and implemented in four African countries including Nigeria, works on increasing the competitiveness of the domestic rice supply to meet increasing regional demand. The project takes a value chain approach from access to inputs for farmers until processing and market infrastructure. Activities are implemented mostly in Jigawa, Kano and Kebbi States, but also in Kaduna and Niger, calling for close coordination with AGRA.
- The four-year (2016-2019) 'Building a Sustainable, Integrated Seed System for Cassava in Nigeria' (BASICS) project is working to strengthen all components of the cassava seed value chain. BASICS is funded by BMGF and implemented by the CGIAR Research Programme on Roots, Tubers, and Bananas. BASICS collaborates closely with NASC, including providing capacity building, which can potentially lead to duplication of activities with AGRA's support.
- HarvestPlus (Phase 3, 2014-2019) is working in 22 states in Nigeria to promote the availability, adoption, and consumption of bio-fortified crops by supporting the National Root Crops Research Institute in the breeding, testing, and release of Vitamin A-rich cassava developed through a partnership with IITA. HarvestPlus is also engaged in the research and release of bio-fortified maize varieties. Funders include the UK government, BMGF, USAID's Feed the Future initiative, and the European Commission.
- The West Africa Agricultural Productivity Programme (WAAPP) is a World Bank-funded programme instituted in 2014 with a goal to increase agricultural productivity in Africa through scaling up of farmers' staple crop output. The strategy involves increasing overall seed supply by making breeder and foundation seeds more readily available. WAAPP contracts mandated NARIs in Nigeria to produce breeder and foundation seed of maize, rice and sorghum for sale to private seed companies with a 40% price support.

While this list is not exhaustive, it indicates that AGRA's activities on seed do not duplicate other initiatives and correspond to system needs that are not addressed by other donors.

Relevance of AGRA's interventions

AGRA has been involved in seed sector development in Nigeria since 2006. In the course of its activities, it has supported a variety of initiatives that aim to increase farmers' access and use of improved seeds, especially through the former PASS initiative. AGRA's current efforts in the seed system align with the established focus on supporting Nigerian seed companies,

but also emphasise regulatory progress and strengthening of seed sector governance through NASC.

The focus on supporting seed companies serves the dual purpose of capacity building and addressing the shortage of EGS and certified seed – also for recognised priority crops of maize and rice – with a high relevance for seed sector development and food security. The collaboration with NASC has the potential to bring about important progress on seed quality control, which is currently one of the critical challenges facing the seed sector. Capacity development of NASC itself is also an important prerequisite to enable this body to fulfil its envisaged functions. Finally, the advocacy efforts to improve legislation are relevant activities to improve the enabling environment of the seed sector.

Expected impact

Increased EGS production
The production and commercialisation of EGS by private seed companies is still lagging in Nigeria. Various stakeholders interviewed emphasised the need to support seed companies, many of which are very small and have a low capital base. There is a shortfall of EGS, especially for maize, rice and soybeans, which impedes farmers' access to certified seed. Capacity building is necessary with regard to human and financial capacity and technical infrastructure. The investments in companies producing maize and rice seed varieties can be considered important in view of food security and import substitution as promoted by APP. It should be noted that AGRA's support and results are limited to two companies.

Increased certified seed production
Despite increased certified seed production due to a number of active private companies in Nigeria, the country is still experiencing a wide gap between supply and actual requirement. According to NASC, in 2018, the total certified seed produced for the seven major crops (maize, rice, sorghum, cowpea, groundnut, millet and soybean) was 72,951 MT, yet the actual requirement was 422,229 MT, resulting in a deficit of 349,227 MT, worth over N130 billion (US$450 million).[2] AGRA's work in the two consortia in Kaduna and Niger States, including the support to four companies to upscale certified seed production, therefore contribute to improving access to and affordability of certified seeds for farmers.

Seed quality control
While this activity was still in the planning stage at the time of research, the envisaged impact is considerable: deploying the electronic authentication system SEEDCODEX is an important step to tackle the problem of adulterated seeds in Nigeria's agricultural sector. Once the SEEDCODEX system is in place, all seeds supplied under any scheme to farmers in Nigeria must meet the electronic authentication system standard. With this step, Nigeria follows the example of some eastern African countries, which have already introduced similar online verification systems for seed packages.

Improved legislation
The National Agricultural Seeds Council Bill from 2019 replaces the National Agricultural Seeds Acts of 2004. This provides legal backing for official testing, certification, sales, importation, exportation and use of seeds in the country. Particularly important elements include the alignment to ECOWAS Seed Regulation framework and a steep increase of

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[2] https://www.sunnewsonline.com/nigeria-to-generate-n423bn-from-certified-seeds-production-nasc/

penalties for counterfeit/adulterated seed marketing. Furthermore, with the new Plant Variety Protection Act, plant breeders in the country who develop new and improved seeds for increased crop production are set to be provided with legal intellectual property rights to the varieties. It is expected that this will facilitate greater investment in breeding and development of new plant varieties by public and private sectors, according to NASC. It can also increase Nigeria's participation in international seed trade, which is currently impeded as a result of lacking IP rights to plant varieties. Finally, it will enable Nigeria to become a UPOV member.

Sustainability of results

Despite the emphasis on private sector-led seed system development, the Nigerian government is considered the largest seed buyer in the country. A consulted stakeholder estimated that if the government stopped buying seeds, only a limited number of seed companies would survive. As the government distributes the seed free-of-charge to farmers, their willingness and ability to purchase seed at commercial terms is limited. According to Smith (2018), despite the official policy objective of private sector participation in the agricultural sector, the government continues to dominate all aspects of agricultural productivity, which makes it difficult for private sector participation to thrive.

Part II: Household survey

6 Methodology of the household survey

6.1 Introduction

One of AGRA's intervention instruments is funding farmer-level interventions through consortia projects and other investments. AGRA considers the continued use of outdated production technologies and practices as one of the biggest hurdles to increasing smallholder farmer productivity in Africa. However, farmers are known to adopt new technologies when they are useful, affordable, and available locally. In the past, AGRA has invested in the development and production of new crop varieties which are higher-yielding, resistant to local pests and diseases, and are more resilient in the face of environmental and climatic stress. In addition, collaborations with the African private sector have contributed to 25,000 village-based agents (VBAs).

Under the PIATA programme, AGRA gives grants to consortia that promote market-oriented agriculture by focussing on improving the productivity and profitability of specific crop commodities (mostly cereals and legumes) for smallholder farmers. These value chain projects provide farmers with access to improved technologies and inputs, training and (structured) markets. The expectation is that smallholder farmers will be assured of a ready market for their produce, which triggers intensification of production, and the buyers (processors or aggregators) will get a steady supply of quality crop produce.

The household-level survey is designed to measure changes at farm level. This is part of the internal monitoring of change within the beneficiary population of AGRA's interventions against an agreed upon (restricted) set of indicators. This allows for the continuous tracking of progress towards its desired outcomes at farm level. The methodology targeted data collection by external local and international consultants under the guidance of and coordination by KIT.

The household's survey monitored the following indicators:
- Average number of months of adequate household food provision (Goal indicator 2)
- Wealth assets index score (Goal indicator 6)
- Average yield (kg/ha) of focus crops
- Rate of application of target improved productivity technologies or management practices at farmer level
- Percent of farmers accessing agricultural advisory extension support services
- Average fertiliser use
- Percent of post-harvest losses
- Value of smallholder incremental sales (value of additional volumes sold)
- Percent of farmers accessing financial services of formal institutions
- Average age of varieties of focus value chains on farmer fields
- Additional indicator 1: Average distance to agro-dealer
- Additional indicator 2: Hectares under improved productivity technologies or management practices
- Additional indicator 3: Farmers' clients
- Additional indicator 4: Small seed pack' exposure and utilisation

6.2   Sampling strategy

As the purpose of this assignment is monitoring performance against specific indicators, AGRA and KIT have jointly decided to opt for a statistically sound, yet targeted sample strategy. Because the purpose is monitoring, AGRA and KIT also agreed not to make use of counterfactuals.

The target population for this study are all AGRA beneficiaries in the Niger and Kaduna regions in Nigeria. The sample size was set at 2,000 households (i.e. 1,000 per crop). Since reliable lists of beneficiaries for sampling were unavailable, the proceeded to sampling households through CBAs. For both crops, a sample of 40 CBAs was randomly selected. For the rice sample, 27 CBAs in Niger State and 13 CBAs in Kaduna State were randomly selected. These numbers were determined proportionally. For the maize sample 40 CBAs in Kaduna State were randomly selected. A buffer of CBAs was selected, in case the CBAs who were sampled originally could not be found. Upon arrival in the community, the team, in consultation with the CBA, randomly sampled 25 beneficiaries per CBA to be interviewed.

In some cases, communities/CBAs had to be replaced from the buffer list, based on non-existence of the community, and inability to reach the CBA after at least three attempts. In Kaduna, the team visited 37 communities from the sample, and 16 communities from the buffer. In Niger, the team visited 19 communities from the sample, and 8 communities from the buffer.

The total number of surveys was agreed between KIT and AGRA, based on budget availability, and power considerations. The sample size per crop was set at 1,000. With a sample size of 1,000 observations, it is expected to detect a change in yields of 10% among the survey population with a confidence level of 95% (see Figure 2).
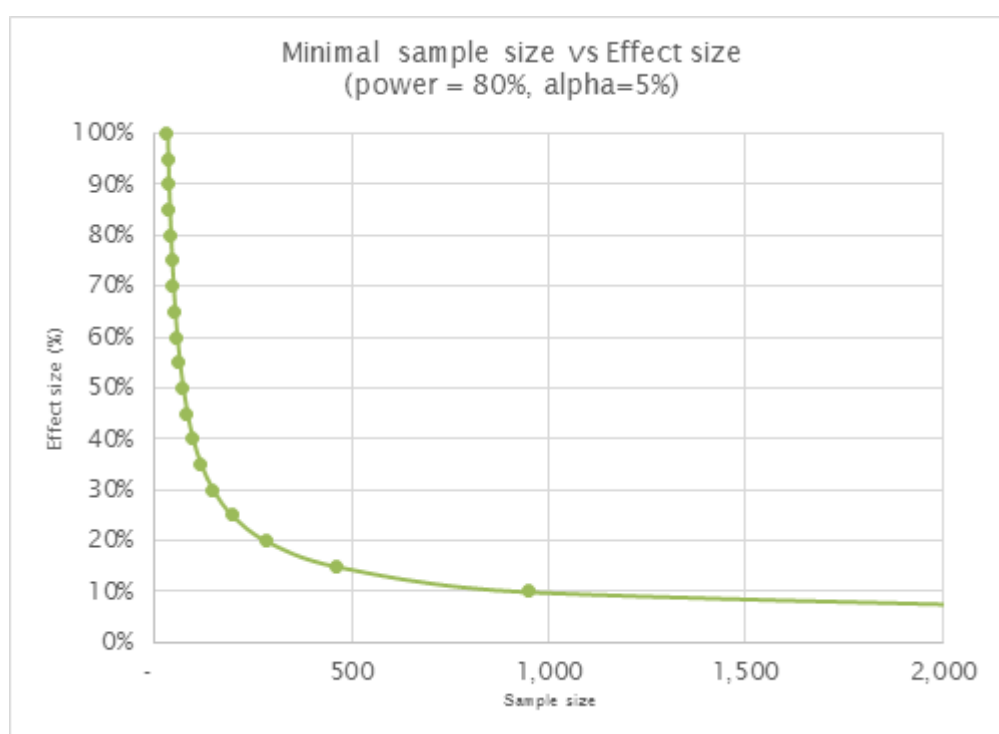
Figure 2: Power calculation

6.3   Survey structure and respondents

The household is the main unit of analysis. Therefore, it is possible that multiple household members were involved in answering questions. The survey always started with AGRA's main beneficiary, but during the survey the respondent could switch. Questions on agricultural production are answered by the person in the household who knows best about production. Questions on household food security are answered by the household member in charge of food and cooking in the household, which was usually a woman.

At the start of the survey, the enumerator selects the crop cultivated by the respondent, which ensures that only questions concerning that crop appear in the interactive form. The same applies for the respective seasons the farmer cultivated the respective crop.

The survey instrument was designed to collect detailed information on the following topics:
- General:
  - Demographics and wealth indicators
- Crop-specific:
  - Agricultural land
  - Production of the focus crop
  - Allocation of the focus crop
  - Revenues
  - Crop varieties and seed use
  - Use of productivity-enhancing technologies
  - Post-harvest practices
  - Farmers' clients
- General:
  - Agricultural extension
  - Financial services
  - Food security

The data was collected using tablets and Open Data Kit (ODK), in combination with the secured survey site Kobo Toolbox. ODK is the leading open-source platform for collecting, storing and processing quantitative survey data. The use of this application ensures quick and reliable data collection. The questionnaire programmed in ODK makes calculations during the survey, which allows for referencing to responses given previously. It also allows for data checks since it reduces the chance of errors by warning enumerators when unexpected values are entered. The form also includes skip-logics that were programmed into the questionnaire, so that enumerators only ask relevant questions based on previous responses, which ensures efficiency in data collection.

6.4   Limitations of the household survey

When interpreting this data, a number of aspects should be kept in mind. Firstly, the purpose of the assignment is 'internal' monitoring of change. As such, the assignment does not require impact measurement of AGRA's and partners' interventions and therefore does not require measuring change against counterfactuals and attribution of results.

Secondly, the survey relies on recall data for the year 2018, while data collection occurred in 2019. Although many checks and quality control mechanisms have been implemented to

ensure data quality, the recall process may introduce some variations between real and reported data.

Furthermore, reliable beneficiary lists were not available in Nigeria and KIT needed to proceed to CBA-based sampling. It should also be kept in mind that the sample is only representative of AGRA's beneficiary population and its representativeness cannot be extended to the wider region or nation.

Finally, it turned out that, at the time of the survey, not all the target beneficiaries were always reached by any AGRA intervention or support.

7 Household-level results: maize in Kaduna State (2018)

7.1 Sample description

Survey area

A total sample of 1,002 maize-cultivating households were interviewed in the Kaduna region. Interviews were conducted in six districts: Giwa district (27%), Ikara district (15%), Kauru district (15%), Kudan district (8%), Lere district (20%) and Makarfi district (15%). Within these districts, 1,002 households, which are supported by 42 CBAs, were visited. Figure 3 shows the geographical spread of surveyed households.
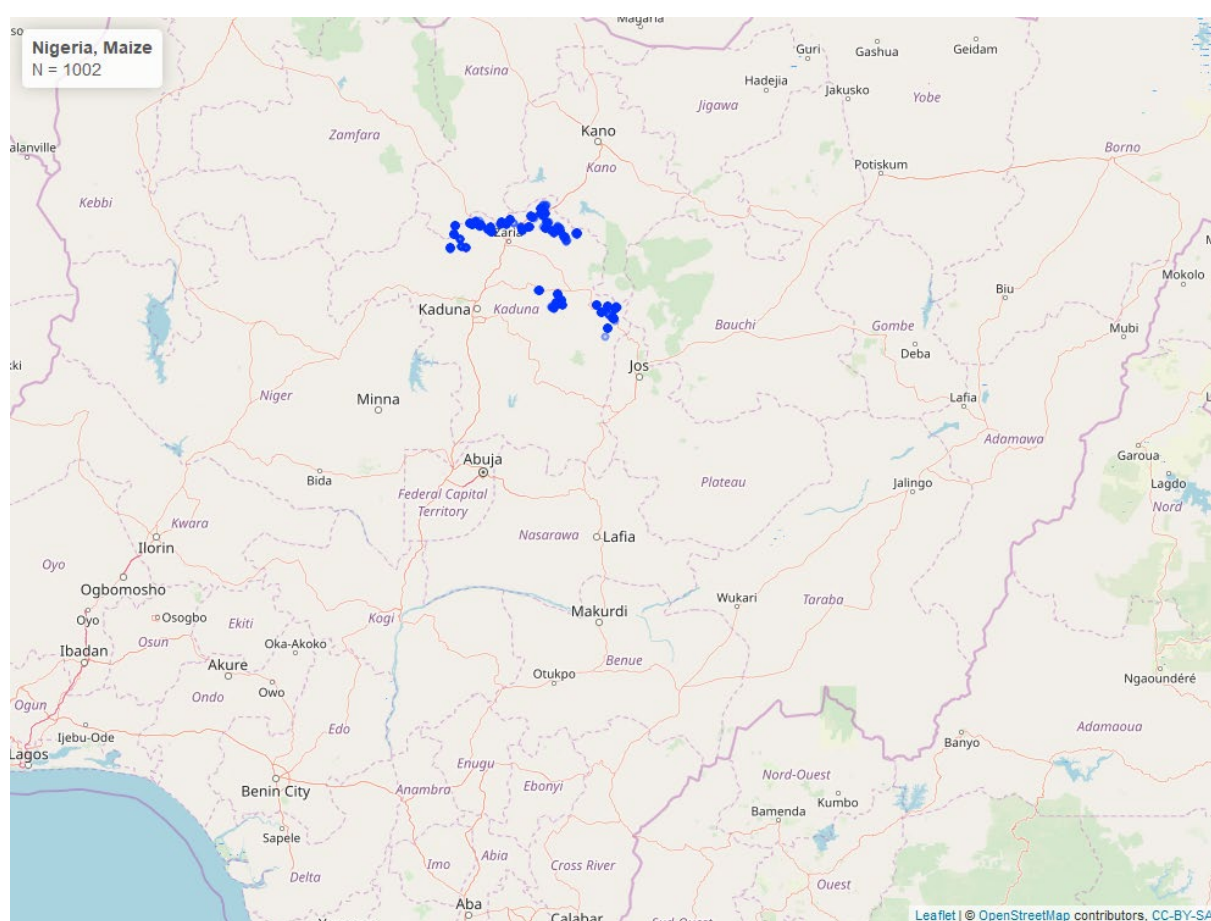
Figure 3: Location of farm household interviews, maize sample

Farm household characteristics (maize farm households)

Respondents were all AGRA beneficiaries: 82% of respondents were male, 18% were female. In 79% of the cases, the beneficiary is also the head of the household. Respondents were, on average, 40 years old (see Figure 4).
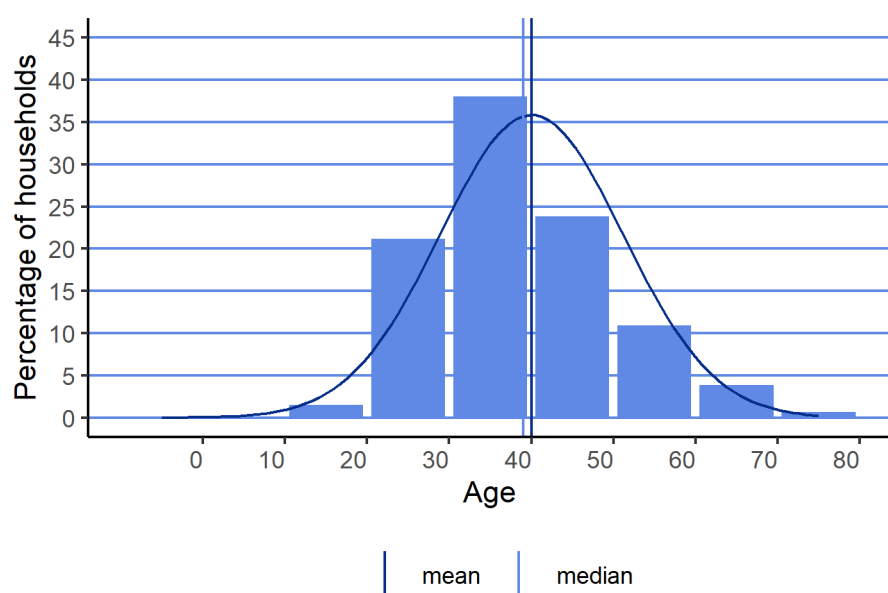
N = 1001

Figure 4: Distribution of respondent age

The vast majority (96%) of farm households are male-headed. Households in Kaduna State are large. On average, they consisted of 11.4 members (5.0 adults and 6.4 children), with female-headed households being significantly smaller (see Table 11).

Table 11: Household composition

Household size	All	Male-headed	Female-headed	sig
Number of children in the household	6.4	6.5	4.9	**
Number of adults in the household	5.0	5.0	4.4	
n	1,001	966	35	

*Note: significance from a one-way ANOVA statistical test. ***, **, * indicate significance levels of 1%, 5% and 10% respectively*

Almost all households (95 %) own agricultural land. The average amount of land owned is 3.3 ha. All 3.3 ha are usually cultivated. Figure 5 shows the land allocated to maize cultivation. A bit more than half of the cultivated land (1.8 ha) is allocated to maize.

Half of the farm households have intercropped maize with other crops. Most commonly, maize is intercropped with cowpea (60%) and sorghum (52%).
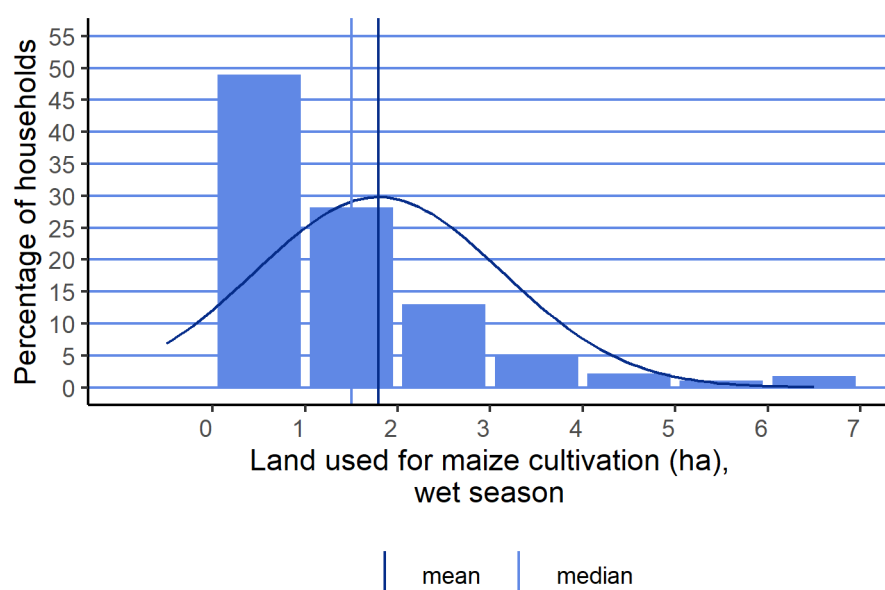
Figure 5: Distribution of land allocated to maize (ha), wet season

In Kaduna, there are two farming seasons for maize: the wet season and the dry season. The main season ranges from May until September. Table 12 shows that all households cultivated maize in the wet season and that – in line with expectations – hardly any household cultivated maize in the dry season. Consequently, this report only presents data for the wet season.

Table 12: Percentage of households producing maize, per season

	All	Male-headed	Female-headed	sig
Wet season	100%	100%	100%	NA
Dry season	0%	1%	0%	
n	1,002	967	35	

Note: significance from a one-way ANOVA statistical test. ***, **, * indicate significance levels of 1%, 5% and 10% respectively
Note: Multiple choices possible, therefore total does not need to add to 100%

7.2   Main indicators

Table 13 gives an overview of the primary indicators collected (see Annex 2. Data dictionary of main indicators for definitions of each indicator). The indicators and the underlying behavioural patterns are discussed in further details in the following sections.

Table 13: Overview of main indicators for maize-farming households

	All	Male-headed	Female-headed
G2: Average number of months of adequate household food provision	**11.0**	**11.1**	**10.4***
G6: Wealth assets index score	**-0.320**	**-0.319**	**-0.348***
G6.1 Share of households in first wealth quintile (%)	7%	7%	3%*

G6.2 Share of households in second wealth quintile (%)	37%	37%	49%*
G6.3 Share of households in third wealth quintile (%)	45%	45%	37%*
G6.4 Share of households in fourth wealth quintile (%)	11%	11%	6%*
G6.5 Share of households in fifth wealth quintile (%)	1%	0%	6%*
IWI International Wealth Index	48.5	48.7	44.1
1. Average yield (kg/ha)	**2781**	**2801**	**2247***
3. Rate of application of target improved technologies or management practices	**99%**	**99%**	**94%***
3.1 Adoption of improved varieties (%)	41%	42%	17%*
3.2 Adoption of endorsed varieties (%)	3%	3%	0%*
3.3 Number of seasons variety is recycled	5.2	5.2	4.4*
3.4 Adoption of endorsed planting practice (%)	11%	11%	9%*
3.5 Adoption of inorganic fertiliser (%)	99%	99%	94%*
3.6 Adoption of endorsed fertiliser (%)	98%	98%	91%*
3.7 Adoption of organic fertiliser (%)	79%	79%	80%*
3.8 Adoption of inoculants (%)	NA	NA	NA
3.9 Adoption of pest-management practices (%)	83%	83%	71%*
3.10 Adoption of endorsed post-harvest practices (%)	40%	40%	40%*
3.11 Adoption of improved storage (%)	0%	0%	0%*
3.12 Use of designated storage facilities (%)	1%	1%	3%*
3.13 Adoption of tablets to preserve quality of recycled seed (%)	24%	24%	14%*
Ha under improved technologies or management practices (%)	**99%**	**99%**	**99%***
3.14 Area under improved varieties (%)	42%	42%	42%*
3.15 Area under inorganic fertiliser (%)	99%	99%	99%*
3.16 Area under pesticides (%)	86%	86%	86%*
4. Access to agricultural advisory extension support services	**40%**	**40%**	**20%***
4.1 Avg. no. of visits per year by agri. advisory extension support services	2.5	2.5	2.3*
4.2 Received small seed pack (%) (additional indicator 4)	35%	36%	29%*
4.3 Used small seed pack (%) (additional indicator 4)	92%	92%	60%*
4.4 Distance to nearest agro dealer (minutes)	21.9	21.9	22.1*
5. Nitrogen application (kg/ha)	**104.8**	**106.1**	**68.1***
5.1 Phosphorus application (kg/ha)	22.9	23.2	15.6*
5.2 Potassium application (kg/ha)	25.1	25.3	19.5*

Average fertiliser use (Total N + P + K, kg/ha)	**149.8**	**151.7**	**99.3***
6. Percent of post-harvest losses (%)	**0%**	**0%**	**1%***
10. Value of incremental sales as a result of AGRA (crop revenue) (US$)	**460.1**	**465.9**	**304.2***
13. Access to formal financial services (%)	**71%**	**71%**	**69%***
13.1 Bank account (%)	70%	71%	69%*
13.2 Agricultural loan (%)	3%	3%	0%*
13.3 Agricultural insurance (%)	1%	1%	0%*
17. Average age of varieties used (years)	**11.6**	**11.6**	**14.0***
33. Sale through structured trading facilities/arrangements (%)	**5%**	**5%**	**3%***
33.1 Selling to traders/middlemen (%)	34%	34%	24%*
33.2 Selling to consumers (%)	2%	2%	7%*
33.3 Selling to friends/neighbours (%)	5%	5%	10%*
33.4 Selling to aggregation centre (%)	0%	0%	0%*
33.5 Selling to farmer organisation (%)	0%	0%	0%*
33.6 Selling to wholesalers (%)	32%	32%	41%*
33.7 Selling to processors (%)	0%	0%	0%*
33.8 Selling to retailers (%)	47%	47%	38%*
33.9 Selling to company (undefined) (%)	4%	4%	7%*
33.10 Selling to institutional buyers (%)	NA	NA	NA
37. Access to market information through formal channel (%)	**3%**	**3%**	**3%***

The composition of variables can be found in the data dictionary in Annex 2; N might vary across indicators
* indicates that the average has been calculated with less than 50 observations

7.3 Number of Months of Adequate Household Food Provision (indicator G2)

Table 14 reports the average number of months of adequate household food provision as per the index of the same name (MAHFP). It shows that AGRA-supported farm households have, on average, enough food to meet their family's needs during 11 months of the year. Female-headed households are less food secure than male-headed households. This difference is statistically significant but small.

Table 14: Average number of months of adequate household food provision (G2)

	All	Male-headed	Female-headed
G2: Average number of months of adequate household food provision	11.0	11.1	10.4

Figure 6 shows the MAHFP distribution: 58% of AGRA beneficiaries reported having had enough food to meet their family's needs during the entire year. Only 0.7% of the farm households did not have enough food during 6 months or more. Nobody reported being chronically food insecure.

N = 1000
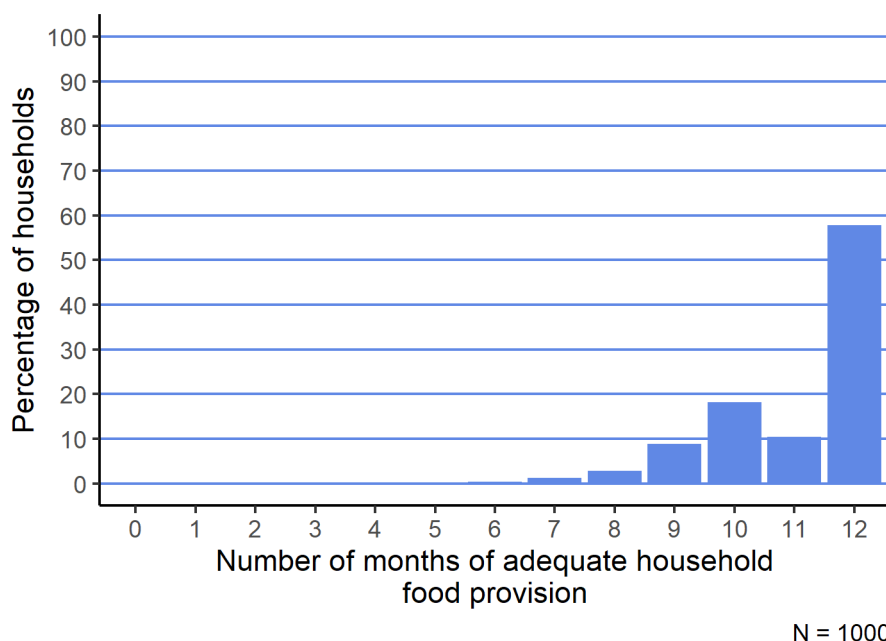
Figure 6: Distribution of number of months of adequate household food provision (G2)

Figure 7 shows the distribution of months with adequate household food provision over the year. The figure shows that the period between August and September were the months in which food insecurity was highest. This is in line with expectations and general patterns of food insecurity, as these months are in the middle of the main cropping season (wet season) and food insecurity is usually highest right before harvest.

N = 1000
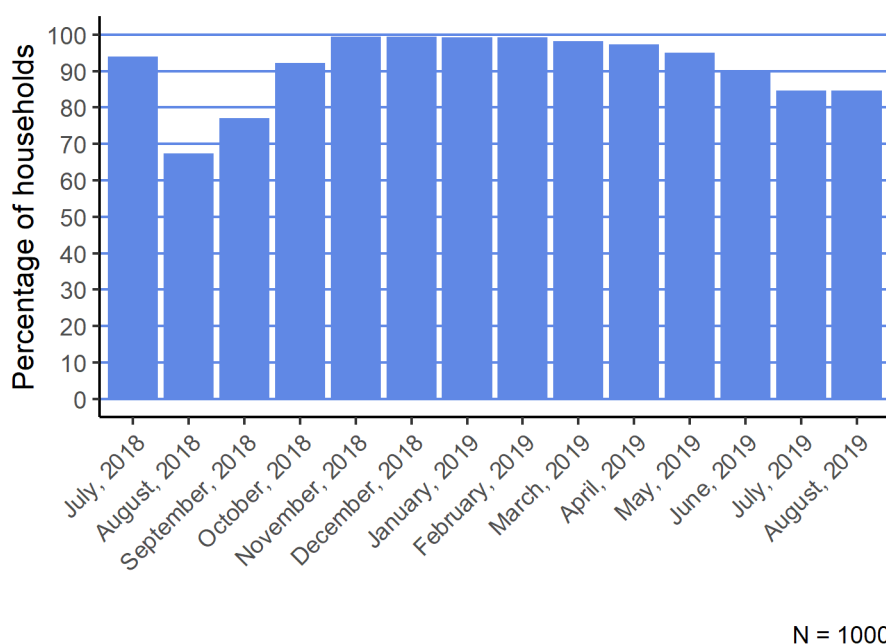
Figure 7: Distribution of months with adequate household food provision

7.4 Wealth asset index score (indicator G6)

Table 15 shows the quintile distribution of the Demographic and Health Surveys (DHS) wealth index. The DHS household wealth index is a composite measure of a household's cumulative living standard. It is composed of data on asset ownership, materials used for housing construction, and types of water access and sanitation facilities (Rutstein, 2015). Wealth index scores were compared with the national Nigerian DHS distribution for rural areas to determine the household's relative wealth as compared to the country average. As can be seen from Table 15, most households are in the 2nd and 3rd quintiles, whilst 7% is in the 1st (poorest) quintile of the country and only 1% is in the 5th (wealthiest) quintile. Households with male heads are, on average, wealthier than households with female heads.

Table 15: DHS wealth index

	All	Male-headed	Female-headed
G6: Wealth assets index score	-0.320	-0.319	-0.348
G6.1 Share of households in first wealth quintile (%)	7%	7%	3%
G6.2 Share of households in second wealth quintile (%)	37%	37%	49%
G6.3 Share of households in third wealth quintile (%)	45%	45%	37%
G6.4 Share of households in fourth wealth quintile (%)	11%	11%	6%
G6.5 Share of households in fifth wealth quintile (%)	1%	0%	6%
IWI International Wealth Index	48.5	48.7	44.1

7.5 Yield (indicator 1)

Maize yields are calculated by dividing the total maize production by the amount of land under maize cultivation. To enhance data accuracy, respondents were able to answer questions in units of their preference for both production and land size. The preferred unit for production was in all cases bags, while the preferred unit of land size was most often hectares, followed by acres. Production and land data units were then converted to kilogrammes and hectares. Out of 1,002 interviewed households, 8 respondents did not know their maize production, while 16 respondents did not know how much land was used to cultivate maize.

Respondents reported an average maize production of 4,631 kg. Figure 8 shows the distribution of quantity of maize harvested. Production is significantly higher among male-headed households (see Table 16).
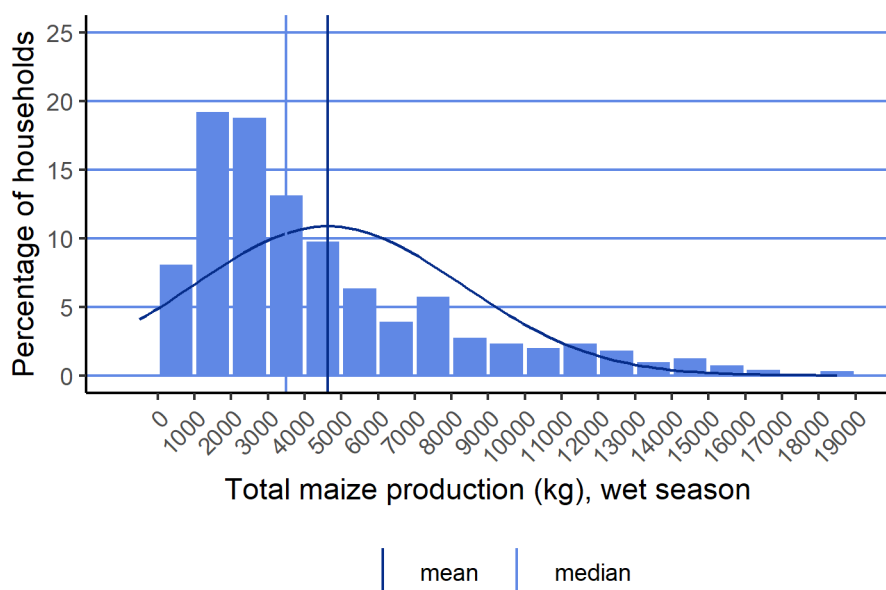
Figure 8: Distribution of total production of maize (kg), wet season

Table 16: Total production of maize (kg), wet season

Total maize production (kg), wet season	All	Male-headed	Female-headed	sig
mean	4,631.1	4,685.2	3,185.3	**
median	3,500.0	3,500.0	1,800.0	
n	943	909	34	

*Note: significance from a one-way ANOVA statistical test. ***, **, * indicate significance levels of 1%, 5% and 10% respectively*

Maize yields are, on average, 2,781 kg/ha (see Table 17 and Figure 9). A substantial difference exists between male-headed and female-headed households. This difference is large (on average 554 kg/ha) and highly significant.

Table 17: Average maize yield (kg/ha)

	All	Male-headed	Female-headed
1. Average yield (kg/ha)	2,781	2,801	2,247
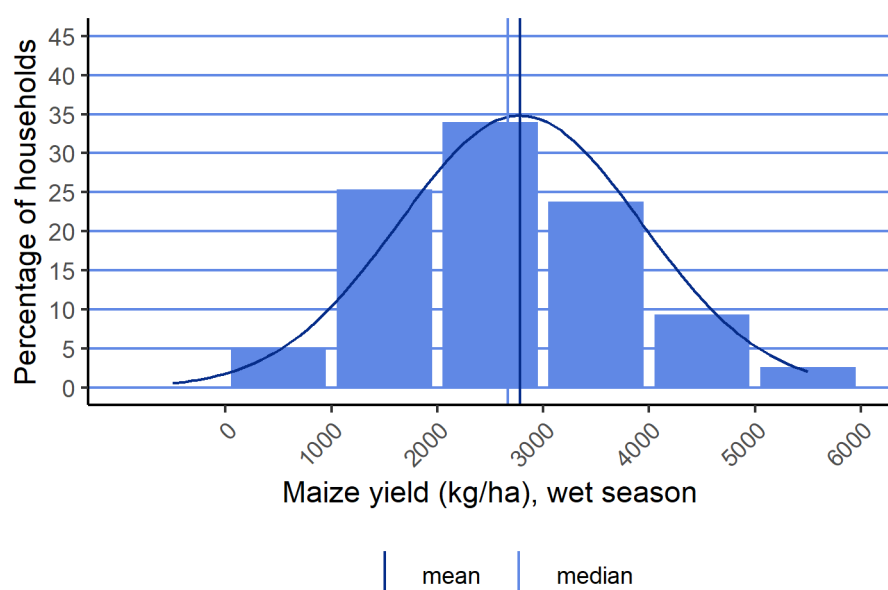
Figure 9: Distribution of average maize yield (kg/ha), wet season

Most farm households (41%) perceived the harvest of the wet season of 2018 to be better than usual; 25% considered it a normal season. The remaining 34% considered the season to be worse than usual (see Table 18).

Table 18: Ranking of this season's maize harvest compared to other seasons (percentage of households per answer), wet season

This season's harvest relative to other seasons	All	Male-headed	Female-headed	sig
Normal	25%	25%	29%	
Worse than usual	34%	33%	37%	
Better than usual	41%	41%	34%	
n	994	959	35	

Note: significance from a Chi-squared statistical test. ***, **, * indicate significance levels of 1%, 5% and 10% respectively

7.6   Rate of application of target improved productivity technologies or management practices (indicator 3, 5, 17)

Improved varieties, recycling and planting practices

Improved varieties
Table 19 shows that 41% of the farm households make use of improved maize varieties. These improved varieties are either hybrids or improved OPVs. AGRA also promotes specific varieties (here referred to as 'endorsed varieties'), which are VSL2065, VSL2425, Obas super 3, Obas super 6, Obas super 11, Obas super 13, OBA-98, SC719 and DK777. According to AGRA, these are high yielding varieties from both supported local seed companies as well as international seed companies. In 2018, 3% of farm households used these endorsed varieties (see Table 19).

Table 19: Main indicators for the use of improved varieties, recycling, and planting practices.

	All	**Male-headed**	**Female-headed**
3.1 Adoption of improved varieties (%)	41%	42%	17%*
3.2 Adoption of endorsed varieties (%)	3%	3%	0%*
3.3 Number of seasons variety is recycled	5.2	5.2	4.4*
3.4 Adoption of endorsed planting practice (%)	60%	60%	46%*
17. Average age of varieties used (years)	11.6	11.6	14.0*
Ha under improved technologies or management practices (%)	99%	99%	99%*

Table 20 lists the varieties grown. It shows that there is large variation in the varieties that are being cultivated. The most outstanding result is that about 31% of households do not know which variety they cultivate. This is more common among female-headed households. Additionally, 28% of households know that they grow a hybrid variety, without knowing the name of the variety. Among endorsed varieties, OBA-98 is used the most. However, with only 1% of households cultivating this variety, uptake is low.

Table 20: Maize varieties used (percentage of households per variety), wet season

Varieties	All	Male-headed	Female-headed	sig
Don't know	31%	30%	57%	***
Hybrid, unspecified	28%	29%	17%	
Other	12%	13%	3%	*
White maize	6%	6%	9%	
Local variety, unspecified	5%	5%	9%	
SAMMAZ 15	4%	4%	0%	
Project maize	2%	2%	3%	
SC or Seed Co, unspecified	1%	2%	0%	
Oba no number	1%	1%	0%	
OBA-98 (promoted)	1%	1%	0%	
Oba Super 3 (promoted)	1%	1%	0%	
SAMMAZ 14	1%	1%	3%	
SAMMAZ 16	1%	1%	0%	
SAMMAZ 17	1%	1%	0%	
DK 8090	1%	1%	0%	
Yar serial	1%	1%	0%	
Mai awure	1%	1%	0%	
Zaffa	1%	1%	3%	
n	1,002	967	35	

Note: significance from a one-way ANOVA statistical test. ***, **, * indicate significance levels of 1%, 5% and 10% respectively
Note: Multiple choices possible, therefore total does not need to add to 100%
Note: Categories smaller than 0.5% are combined in 'Other'

Table 21 groups the varieties that are cultivated in the hybrid, local variety, or OPVs categories. However, due to the large number of households that did not exactly know the variety they cultivate, about half of the varieties could not be classified within one of the groups.

Table 21 also shows that 33% of farm households have, in fact, cultivated a hybrid variety, which means that hybrid varieties are more common than local varieties. Furthermore, 8% of the varieties used are OPVs, while only 7% are local varieties. The total percentage of households cultivating improved maize varieties is thus around 41%, which is slightly below the estimated average for Nigeria (about 50%), as presented in section 5.1 of this report.

There are large differences between male and female-headed households. While 34% of the male-headed households cultivates a hybrid variety, this is only 14% for the female-headed households. Female-headed households were more often unable to name the variety they cultivate, which may partly explain the difference. Additionally, female-headed households are slightly more likely to use a local variety than male-headed households.

Table 21: Type of main maize variety (percentage of households per variety type), wet season

Type of main variety, wet season	All	Male-headed	Female-headed	sig
Not able to classify	52%	51%	74%	
Hybrid	33%	34%	14%	**
OPV	8%	8%	3%	
Local variety	7%	7%	9%	
n	1,002	967	35	

Note: significance from a Chi-squared statistical test. ***, **, * indicate significance levels of 1%, 5% and 10% respectively

The main motivation for selecting a certain variety is, by far, yields (97%). Additionally, households select varieties based on favourable maturing time (54%), taste (29%) or on their suitability for easy processing (29%). Table 22 shows that maturing time, processing and conservation were significantly more important traits for male-headed households than for female-headed households.

Table 22: Appreciated traits of the main maize variety used (percentage of households per trait), wet season

Maize variety traits	All	Male-headed	Female-headed	sig
Yields	97%	96%	97%	
Maturing time	54%	55%	34%	**
Taste	29%	30%	17%	
Processing	29%	29%	11%	**
Tolerance to pests	25%	25%	23%	
Appreciated by buyers (market)	25%	25%	14%	
Conservation (storage time)	23%	24%	6%	**
Tolerance to diseases	16%	16%	17%	
Colour	16%	16%	9%	
Price and/or premium from buyers	9%	10%	3%	
Tolerance to droughts	4%	4%	3%	
Other	4%	5%	3%	
Tolerance to floods	2%	2%	0%	

Maize variety traits	All	Male-headed	Female-headed	sig
It was free	2%	2%	0%	
n	1,002	967	35	

Note: significance from a one-way ANOVA statistical test. ***, **, * indicate significance levels of 1%, 5% and 10% respectively
Note: Multiple choices possible, therefore total does not need to add to 100%
Note: Categories smaller than 1% are combined in 'Other'

The average number of years since release in the national catalogue of hybrid and OPV varieties used by farming households is 19.7 years (see Table 23). Seeds are, on average, recycled for 5.2 seasons before they are renewed. Table 24 shows the source of seeds. Agro-dealers are the most important sources for all variety types. After that, the source differs per variety. Besides the agro-dealer, local varieties are most often obtained from the field of a community member (25%), while OPVs come from seed companies (26%) and research institutes (17%). Besides agro-dealers, hybrids are often obtained from seed companies (15%) and farmers organisations (11%). Many farm households (20%) also indicate obtaining their hybrids from other (unknown) sources.

Table 23: Age of main maize variety (years), wet season

Age of main variety (years), wet season	All	Male-headed	Female-headed	sig
mean	11.6	11.6	14.0	
median	11.0	11.0	14.0	
n	105	104	1	

Note: significance from a one-way ANOVA statistical test. ***, **, * indicate significance levels of 1%, 5% and 10% respectively
n = number of Hybrid/OPV varieties of which the age could be classified. Age could not be classified for 27% of Hybrid and OPV varieties.

Table 24: Source of seed of main maize variety (percentage of households per source), by type of variety, wet season

Source of the seed, wet season	All	Local variety	OPV	Hybrid	sig
Recycled from the field of friend/family/neighbour… etc.	24%	25%	11%	0%	
Seed company	13%	0%	26%	15%	
Agro-dealer	37%	60%	30%	38%	
Market stall (not specifically for inputs)	5%	10%	0%	4%	
Farmer organisation	10%	0%	9%	11%	
Research institute	3%	5%	17%	3%	
NGO distribution	3%	0%	2%	6%	
Government extension services	3%	0%	6%	3%	
Other	2%	0%	0%	20%	
n	492	20	47	194	

Note: significance from a Chi-squared statistical test. ***, **, * indicate significance levels of 1%, 5% and 10% respectively
Note: Categories smaller than 1% are combined in 'Other'

Contrary to expectations, no significant difference in yield exists between the different subsets of variety types (see Table 25).

Table 25: Average maize yield (kg/ha), by type of variety, wet season

Maize yield (kg/ha), wet season	All	Local variety	OPV	Hybrid	sig
mean	2,781.1	2,607.7	2,914.2	2,923.3	
median	2,666.7	2,600.0	2,750.0	2,965.3	
n	924	68	70	311	

Maize yield (kg/ha), wet season	All	Local variety	OPV	Hybrid	sig

Note: significance from a one-way ANOVA statistical test. ***, **, * indicate significance levels of 1%, 5% and 10% respectively

Planting practices

Table 19 shows the percentage of farm households adopting endorsed planting practices. In Nigeria, the planting practice promoted by AGRA concerns spacing and the number of seeds per hole: farmers are advised to plant 1 seed per hole, with a spacing of 25cm intra-row and 75cm inter-row. Around 60% of households use this endorsed planting practice. All farm households plant using fixed spacing; broadcasting and scattering are not applied in Nigeria. Table 26 shows that 25-75cm is the most commonly used spacing.

Table 26: Spacing between maize seeds (percentage of households per method), wet season

Planting method, spacing, wet season	All	Male-headed	Female-headed	sig
25-75 cm	63%	63%	62%	
20-80 cm	6%	6%	8%	
40-80 cm	15%	15%	15%	
20-70 cm	14%	14%	12%	
Other	2%	2%	4%	
n	953	927	26	

Note: significance from a Chi-squared statistical test. ***, **, * indicate significance levels of 1%, 5% and 10% respectively
Note: Categories smaller than 1% are combined in 'Other'

Fertiliser use

Table 27 presents the main indicators on fertiliser use. Almost all farm households (99%) apply inorganic fertiliser. Farmers that apply fertiliser typically do this on all their cultivated land; thus, in total, 99% maize land gets applied with fertilisers.

Table 27: Main indicators for the adoption and use of fertilisers

	All	Male-headed	Female-headed
3.5 Adoption of inorganic fertiliser (%)	99%	99%	94%*
3.6 Adoption of endorsed fertiliser (%)	98%	98%	91%*
3.7 Adoption of organic fertiliser (%)	79%	79%	80%*
3.15 Area under inorganic fertiliser (%)	99%	99%	99%*
5. Nitrogen application (kg/ha)	104.8	106.1	68.1*
5.1 Phosphorus application (kg/ha)	22.9	23.2	15.6*
5.2 Potassium application (kg/ha)	25.1	25.3	19.5*
Average fertiliser use (Total N + P + K, kg/ha)	149.8	151.7	99.3

In Nigeria, AGRA promotes NPK (with a 20-10-10 formula) and urea. With 98% of farm households applying these fertilisers, uptake is very high. The NPK formula 15-15-15 is however much more common with 94% of NPK users applying this formula and only 5% using the AGRA recommended blend. Other fertilisers used in Nigeria are triple

superphosphate (TSP) and ammonium sulphate, but these are only used by a small share of farmers (below 1%).

On average, NPK users apply 175.0 kg of NPK per ha. Urea application is, on average among users, 197 kg/ha. Male-headed households generally apply more fertiliser per land unit than female-headed households. This difference is significant for urea.

Among all households interviewed, nitrogen is the macronutrient applied in the largest quantity (104.8 kg/ha), followed by potassium (25.1 kg/ha) and phosphorous (22.9 kg/ha). Land of male-headed households got applied with significantly more nutrients than that of female-headed households. Additionally, low quantities of the secondary macronutrients, sulphur and calcium, are applied in Nigeria (see Table 28). None of the sampled farmers apply micronutrients.

Table 28: Nutrients applied for maize (kg/ha), wet season

	All	Male-headed	Female-headed	sig
Nitrogen application (kg/ha), wet season	104.8	106.1	68.1	***
Phosphorus application (kg/ha), wet season	22.9	23.2	15.6	***
Potassium application (kg/ha), wet season	25.1	25.3	19.5	**
Sulfur application (kg/ha), wet season	0.3	0.3	0.0	
Calcium application (kg/ha), season i	0.1	0.1	0.0	
Magnesia application (kg/ha), wet season	0.0	0.0	0.0	NA
Boron application (kg/ha), wet season	0.0	0.0	0.0	NA
Zinc application (kg/ha, wet season	0.0	0.0	0.0	NA
n	998	963	35	

*Note: significance from a one-way ANOVA statistical test. ***, **, * indicate significance levels of 1%, 5% and 10% respectively*
n = households that cultivated maize

The most common source of information on fertiliser types is observation in the community (73%). Eight (8%) percent of households received information on fertiliser type from the CBA. The majority of households has used fertiliser for longer than five years. The most common fertiliser application method is dropping fertiliser by the seed; 60% use this method. Top dressing at planting is also a popular method.

The majority of households (79%) use organic fertiliser. Organic fertiliser is most often manure (86%) or compost (41%) (see Table 29). None of the farm households use granular fertiliser. Information on organic fertilisers mainly comes from traditional knowledge. Most farm households (76%) obtain information on organic fertiliser from other people in their household or community members. The large majority of farmers have used organic fertiliser for longer than five years.

Table 29: Types of organic fertiliser used for maize (percentage of households per type)

Types of organic fertiliser	All	Male-headed	Female-headed	sig
Granular	0%	0%	0%	
Compost	41%	42%	29%	
Manure	86%	86%	96%	
Crop residues	6%	6%	7%	

Types of organic fertiliser	All	Male-headed	Female-headed	sig
n	792	764	28	

*Note: significance from a one-way ANOVA statistical test. ***, **, * indicate significance levels of 1%, 5% and 10% respectively*
Note: Multiple choices possible, therefore total does not need to add to 100%
n = households that apply fertiliser

Differences in productivity between farm households who apply fertiliser and farm households who do not are large. In line with expectations, yields are higher amongst farmers that apply fertilisers (see Table 30). This difference of more than 2 t per ha is highly significant.

Table 30: Average maize yield (kg/ha), by fertiliser use (yes/no), wet season

Maize yield (kg/ha), wet season	All	No	Yes	sig
mean	2,781.1	598.6	2,790.3	***
median	2,666.7	597.1	2,700.0	
n	924	4	919	

*Note: significance from a one-way ANOVA statistical test. ***, **, * indicate significance levels of 1%, 5% and 10% respectively*

Pest management practices

Table 31 shows the percentage of households that have adopted pest management practices. Adoption of pest management practices is defined as the percentage of households applying pesticides, herbicides and/or fungicides.

Table 31: Adoption of pest-management practices

	All	Male-headed	Female-headed
3.9 Adoption of pest-management practices (%)	83%	83%	71%*

Out of the three types of agro-chemicals, herbicides are used most (82%), followed by pesticides (10%) (see Table 32). Male-headed households apply herbicides more often than female-headed households. Only 1% of households use fungicides; among this 1% are relatively many female-headed households (3%).

Table 32: Percentage of households applying agro-chemical inputs, wet season

	All	Male-headed	Female-headed	sig
Pesticide application, wet season	10%	10%	11%	
Herbicide application, wet season	82%	83%	71%	*
Fungicide application, wet season	1%	0%	3%	**
n	1,001	966	35	

*Note: significance from a one-way ANOVA statistical test. ***, **, * indicate significance levels of 1%, 5% and 10% respectively*

In most cases, agro-chemicals are applied on the entire land area; 77% of total land area is treated with herbicides and 10% is treated with pesticides (see Table 33). Due to the low number of households applying fungicides, fungicides are applied on less than 1% of cultivated land.

Table 33: Percentage of total land area used for maize cultivation under agro-chemical inputs, wet season

	All	Male-headed	Female-headed	sig
Percentage of total land area under pesticides, wet season	10%	10%	11%	
Percentage of total land area under herbicides, wet season	77%	78%	65%	*
Percentage of total land area under fungicides, wet season	0%	0.0	0.02%	**
n	1,002	967	35	

Note: significance from a one-way ANOVA statistical test. ***, **, * indicate significance levels of 1%, 5% and 10% respectively

In almost all cases (99%), farmers apply herbicides before weeds emerge; 15% of households also apply herbicides pre-emergence (see Table 34). Pre-emergence application of herbicides is an endorsed practice by AGRA. Only 1% only apply herbicides after the emergence of weeds. In addition to herbicide use, 94% of households apply weeding. On average, people carry out weeding two times per season.

Table 34: Timing of herbicide application for maize (percentage of households per answer), wet season

	All	Male-headed	Female-headed	sig
Pre-emergence (promoted)	99%	98%	100%	
Post-emergence	16%	16%	8%	
n	824	799	25	

Note: significance from a one-way ANOVA statistical test. ***, **, * indicate significance levels of 1%, 5% and 10% respectively
Note: Multiple choices possible, therefore total does not need to add to 100%
n = households that apply herbicides

Frequently used pesticides include Titan (18%) and DD Force (15%). However, survey results show that most farmers (66%), in fact, use other types of pesticides besides those listed (see Table 35). Almost one third of households only started applying pesticides in the last wet season. Information on pesticides is most often obtained from other community members (49%) and 37% of farmers obtain information from their CBA.

Table 35: Type of pesticides applied (percentage of households per type), wet season for maize (percentage of households per type)

Types of pesticides	All	Male-headed	Female-headed	sig
Titan	18%	18%	25%	
DD Force	15%	15%	0%	
Emmemictine	1%	1%	0%	
Other	66%	66%	75%	
n	103	99	4	

Note: significance from a one-way ANOVA statistical test. ***, **, * indicate significance levels of 1%, 5% and 10% respectively
Note: Multiple choices possible, therefore total does not need to add to 100%
Note: Categories smaller than 0.1% are combined in 'Other'
n = households that apply pesticides

Post-harvest practices

Table 36 shows the main indicators on the post-harvest practices endorsed by AGRA with the purpose of minimising post-harvest losses. Various post-harvest practices are captured in four indicators. The adoption of endorsed post-harvest practices (indicator 3.10) is defined as the use of a sheet or tarpaulin at least once during maize processing (drying and threshing). The adoption of improved storage facilities (indicator 3.11) measures the

percentage of farmers storing maize double in silos or liner hermetic storage bags (such as Purdue Improved Crop Storage (PICS) bags). Households use designated storage facilities (indicator 3.12) when they store maize at farmer organisations, private storage facilities, or through the warehouse receipt systems.

Table 36: Main indicators for the adoption of improved post-harvest practices

	All	Male-headed	Female-headed
3.10 Adoption of endorsed post-harvest practices (%)	40%	40%	40%*
3.11 Adoption of improved storage (%)	0%	0%	0%*
3.12 Use of designated storage facilities (%)	1%	1%	3%*
3.13 Adoption of tablets to preserve quality of recycled seed (%)	24%	24%	14%*

Less than half of households (40%) use a tarpaulin at least once during processing. Table 37 shows that 38% of households use a tarpaulin when drying maize (a practice promoted by AGRA). In most cases (83%), households learned about tarpaulin use from observation in the community 91% of households that use a tarpaulin have been doing so for more than four years.

Table 37: Use of sheeting when drying maize (percentage of households), wet season

Usage of sheet/tarpaulin when drying maize, wet season	All	Male-headed	Female-headed	sig
mean	38%	38%	37%	
n	1,002	967	35	

*Note: significance from a one-way ANOVA statistical test. ***, **, * indicate significance levels of 1%, 5% and 10% respectively*

Tarpaulin use is higher for threshing maize: among the households that manually thresh maize, tarpaulin use during threshing was 89% (see Table 38). Again, households' main source of information on tarpaulin use is observation in the community (69%); 87% of households that use tarpaulins for threshing have been doing so over four years.

Table 38: Use of sheets for manual threshing of maize (percentage of households), wet season

Usage of sheet/tarpaulin when threshing maize, wet season	All	Male-headed	Female-headed	sig
mean	89%	89%	83%	
n	62	56	6	

*Note: significance from a one-way ANOVA statistical test. ***, **, * indicate significance levels of 1%, 5% and 10% respectively*

AGRA promotes the use of threshing machines for maize. Table 38 indicates that uptake of mechanical threshing may indeed be very high. only 6% of households (n=62) stated that they manually thresh their maize.

When it comes to improved storage facilities, PICS bags are not widely used among the sample population (Table 39). Only one single person indicated making use of PICS bags. Consequently, the uptake of improved storage facilities is very low in Kaduna.

Table 39: Percentage of households using PICS bags for maize storage, wet season

Usage of PICS bags, wet season	All	Male-headed	Female-headed	sig
mean	0%	0%	0%	
n	1,001	967	35	

*Note: significance from a one-way ANOVA statistical test. ***, **, * indicate significance levels of 1%, 5% and 10% respectively*

While the use of improved storage facilities is low, the use of preservative tablets that prevent losses in the maize stock is a bit higher. Table 40 shows that 24% of the farmers keeping a seed stock make use of tablets that prevent quality loss of the seed stock.

Table 40: Use of preservative tablets for maize seeds, wet season

Usage of preservative tablets for maize seeds, wet season	All	Male-headed	Female-headed	sig
mean	24%	24%	14%	
n	598	584	14	

*Note: significance from a one-way ANOVA statistical test. ***, **, * indicate significance levels of 1%, 5% and 10% respectively*

Besides stocking maize with the purpose of personal consumption later, it can also be stocked for the purpose of selling it later (when prices are higher); 36% of households stock maize for this purpose. On average, households stocked 390 kg. The percentage of households using designated storage facilities is low: only 3% store their harvest in rented private storage places. Female-headed households make use of private storage more frequently than male-headed households. All other households that stock maize use their own storage facilities (see Table 41).

Table 41: Type of storage used for maize (percentage of households per type), wet season

	All	Male-headed	Female-headed	sig
Own storage	98%	98%	93%	
Farmer organisation storage	0%	0%	0%	NA
Warehouse receipt system	0%	0%	0%	
Private storage rental	3%	3%	7%	
n	371	357	14	

*Note: significance from a one-way ANOVA statistical test. ***, **, * indicate significance levels of 1%, 5% and 10% respectively*
Note: Multiple choices possible, therefore total does not need to add to 100%

7.7   Access to agricultural advisory support services (indicator 4)

Access to agricultural advisory extension support services is defined as the percentage of households that interacted with an agricultural extension officer during the last 12 months. During these months, 40% of households were visited by an agricultural extension officer (see Table 42). On average, households that met with an extension officer were visited between two and three times.

AGRA aims to supply all its beneficiary farmers with small seed packs, either through a VBA or an extension officer. However, for the 2018 season, only 35% of surveyed households received such a pack.

Table 42: Main indicators for access to agricultural advisory support services

	All	Male-headed	Female-headed
4. Access to agricultural advisory extension support services	40%	40%	20%*
4.1 Avg. no. of visits per year by agri. advisory extension support services	2.5	2.5	2.3*
4.2 Received small seed pack (%) (additional indicator 4)	35%	36%	29%*
4.3 Used small seed pack (%) (additional indicator 4)	92%	92%	60%*
4.4 Distance to nearest agro-dealer (minutes)	21.9	21.9	22.1*

Table 43 shows that extension officers were most often affiliated with the Nigerian government (74%). This number includes both the federal government and the state; 52% of extension officers were affiliated with NGOs. Interestingly, all female-headed households were visited by an NGO-affiliated extension officer; 31% of extension officers were CBAs.

Table 43: Affiliation of extension service provider (percentage of households per provider)

Type	All	Male-headed	Female-headed	sig
Government	74%	74%	86%	
NGO	52%	51%	100%	**
Farmer promoter/CBA	31%	30%	57%	
Company	15%	15%	14%	
Don't know	2%	2%	0%	
Other	0%	0%	0%	
n	651	644	7	

Note: significance from a one-way ANOVA statistical test. ***, **, * indicate significance levels of 1%, 5% and 10% respectively
Note: Multiple choices possible, therefore total does not need to add to 100%
Note: Categories smaller than 1% are combined in 'Other'

Part of the consortium activities in Kaduna and Niger entails the establishment of demonstration plots ('mother and baby demos') for selected seed varieties to train farmers on the use of improved seeds and good agricultural practices. The results show that, indeed, the extension method that is most common among the people that have participated in any kind of extension activities is the use of a demonstration plot (see Table 44): 44% of farmers indicated having engaged in demonstrations. Farmer field schools, technology packages and support by farmer promoters (CBAs) were mentioned by 33%, 18% and 9% of the farm households, respectively.

Table 44: Type of extension method used (percentage of households per method)

Method	All	Male-headed	Female-headed	sig
Demonstration plot	44%	44%	27%	
Farmer Field Schools	33%	33%	27%	
Technology packages	18%	18%	0%	
Support by farmer promoter	9%	10%	0%	
Mentoring by lead farmers	7%	7%	0%	
Transfer of knowledge within farmer organisation/Training of trainers	5%	6%	0%	
Don't know	2%	2%	9%	
None	39%	39%	45%	
Other	0%	0%	0%	NA
n	1011	1000	11	

Note: significance from a one-way ANOVA statistical test. ***, **, * indicate significance levels of 1%, 5% and 10% respectively
Note: Multiple choices possible, therefore total does not need to add to 100%
Note: Categories smaller than 1% are combined in 'Other'

Another aspect of advisory extension services is the distribution and use of promotional seed packs consisting of 100 g of seed. Distribution of promotional seed packs is part of AGRA's consortia activities. These promotional seed packs are provided by the four seed companies involved in the consortia, with the purpose of creating awareness and letting farmers experiment with the seeds on their own plots. Table 42 shows that 35% of households received a small seed pack. The uptake of promotional seed packs is high: 92% of farmers planted the seeds from the received seed pack.

Generally, appreciation of the seed packs is high: 97% of the households that planted the seeds are appreciative of them. Table 45 shows that farmers mainly appreciate the seeds for their yields and the (short) maturing time. Other appreciative aspects that were also frequently mentioned include tolerance to pests (37%) and taste (30%).

Table 45: Variety traits that are positively appreciated of the promotional maize seed pack (percentage of households per trait)

Maize variety traits	All	Male-headed	Female-headed	sig
Yields	97%	97%	100%	
Maturing time	70%	70%	67%	
Tolerance to pests	37%	37%	33%	
Taste	30%	30%	33%	
Processing	26%	27%	0%	
Conservation (storage time)	25%	25%	0%	
Tolerance to diseases	21%	21%	17%	
Colour	16%	16%	0%	
Appreciated by buyers (market)	15%	15%	17%	
It was free	13%	13%	0%	
Price and/or premium from buyers	6%	6%	17%	
Tolerance to floods	3%	3%	0%	
Tolerance to droughts	3%	3%	17%	*
Other	5%	5%	0%	
n	317	311	6	

Maize variety traits	All	Male-headed	Female-headed	sig

Note: significance from a one-way ANOVA statistical test. ***, **, * indicate significance levels of 1%, 5% and 10% respectively
Note: Multiple choices possible, therefore total does not need to add to 100%
Note: Categories smaller than 1% are combined in 'Other'
n = households that appreciated the seeds from the promotional seed pack

Access to agricultural extension services also includes distance to the nearest agro-dealer. Distance to agro-dealers is based on travel time. As can be seen in Table 46, average travel time is 21 minutes. When visiting the agro-dealer, households most often go by foot or motorbike (indicated by 36% and 30%, respectively), followed by trucks (11%) and buses (10%).

Table 46: Average travel time to agro-dealer (minutes)

Distance to agro-dealer in minutes	All	Male-headed	Female-headed	sig
mean	21.9	21.9	22.1	
median	15.0	15.0	15.0	
n	836	803	33	

Note: significance from a one-way ANOVA statistical test. ***, **, * indicate significance levels of 1%, 5% and 10% respectively
n = number of people who answered in time-unit

7.8   Access to formal financial services (indicator 13)

Table 47 shows that 71% of surveyed households have access to formal financial services, which means that 71% of households have access to at least one bank account, a formal agricultural loan, or agricultural insurance. This indicator thus only includes access to formal financial services, provided by formal financial institutions, and excludes access to informal financial services, such as from village money lenders, relatives, or saving groups.

Table 47: Main indicators for access to formal financial services

	All	Male-headed	Female-headed
13. Access to formal financial services (%)	71%	71%	69%*
13.1 Bank account (%)	70%	71%	69%*
13.2 Agricultural loan (%)	3%	3%	0%*
13.3 Agricultural insurance (%)	1%	1%	0%*

Assessing the three components of this variable, it is observed that the most accessible financial service is a bank account; around 70% of households have at least one bank account. Much lower, with 3%, is access to a loan. Only 1% of households took agricultural insurance in 2018.

While only 3% of the farm households took a loan through a formal arrangement (banks, microfinance institutions, savings and credit cooperatives or mobile money), in total 31% of the farmers took a loan in 2018.

Table 48 shows the types of loan providers that are being used. It shows that that only 11% of the loans were provided by formal financial institutions (bank or SACCO). Most common are financial loans via family or friends, and companies.

Table 48: Types of loan providers (percentage of households per provider)

Loan providers	All	Male-headed	Female-headed	sig
Family or friends	78%	77%	100%	*
Village money lender	1%	1%	0%	
Savings and Credit Cooperative (SACCO)/Credit Union	8%	8%	0%	
Bank	3%	3%	0%	
Company	11%	12%	0%	
Other	1%	1%	0%	
n	312	301	11	

*Note: significance from a one-way ANOVA statistical test. ***, **, * indicate significance levels of 1%, 5% and 10% respectively*
Note: Multiple choices possible, therefore total does not need to add to 100%
Note: Categories smaller than 1% are combined in 'Other'
Excluding households that did not take loans

7.9 Post-harvest losses (indicator 6)

Post-harvest losses are measured by the maize that was lost after harvesting (i.e. at farm level) as a share of total production.

Table 49: Main indicator for post-harvest losses

	All	Male-headed	Female-headed
6. Percent of post-harvest losses (%)	0%	0%	1%*

Table 49 shows that post-harvest losses are low; the average of 0% indicates that almost no maize was lost post-harvest. The majority of the sample (68%) did not lose *any* maize post-harvest and the remaining 32% suffered some losses, but extremely low amounts. These farmers lost between 250 g and 85 kg – on average 11.6 kg, which is below 1% of their harvest. Therefore, the overall percentage of post-harvest losses stays at 0% (0.4% to be exact).

When interpreting this data, it should be kept in mind that post-harvest losses are typically difficult to estimate for farmers, as losses are usually not measured and, hence, not counted. Other studies suggest that post-harvest losses for maize in Nigeria are around 13-22% (AGRA, 2014; Mada et al., 2014; Lisa et al., 2019).

7.10 Access to market information (indicator 37)

Only 3% of maize farm households have access to formal channels of market information, such as information through SMS, radio, television, internet and the farmer's organisation (see Table 50).

Table 50: Main indicator for access to market information

	All	Male-headed	Female-headed
37. Access to market information through formal channel (%)	3%	3%	3%*

Farmers do, however, use informal channels to collect market information. Table 51 shows that, amongst farmers who sell their maize, market information is mainly acquired from the market itself (96%) and, to a lesser extent, from other buyers (21%) and from other farmers (15%).

Table 51: Sources of market information used by farmers selling maize (percentage of households per source)

Source of market information	All	Male-headed	Female-headed	sig
Market	96%	96%	100%	
Buyer	21%	21%	21%	
Farmer to farmer	15%	15%	3%	*
Radio	4%	4%	3%	
Other	2%	2%	0%	
n	909	880	29	

*Note: significance from a one-way ANOVA statistical test. ***, **, * indicate significance levels of 1%, 5% and 10% respectively*
Note: Multiple choices possible, therefore total does not need to add to 100%
Note: Categories smaller than 1% are combined in 'Other'
n = households that sold maize

7.11 Sales channels (indicator 33)

Table 52 shows the main indicators for farmers' sales channels. It includes information on sale through structured trading facilities or arrangements, as well as information on farmers' clients.

Table 52: Main indicators on farmers' sales channels

	All	Male-headed	Female-headed
33. Sale through structured trading facilities/arrangements (%)	5%	5%	3%*
33.1 Selling to traders/middlemen (%)	34%	34%	24%*
33.2 Selling to consumers (%)	2%	2%	7%*
33.3 Selling to friends/neighbours (%)	5%	5%	10%*
33.4 Selling to aggregation centre (%)	0%	0%	0%*
33.5 Selling to farmer organisation (%)	0%	0%	0%*
33.6 Selling to wholesalers (%)	32%	32%	41%*
33.7 Selling to processors (%)	0%	0%	0%*
33.8 Selling to retailers (%)	47%	47%	38%*
33.9 Selling to company (undefined) (%)	4%	4%	7%*
33.10 Selling to institutional buyers (%)	NA	NA	NA

A household is considered selling through a structured trading facility when they sell at least part of their harvest through a formal contract and when they know who the buyers will be at the time of planting. Only a very small percentage of 5% of farmers sell their harvest under a formal contract; almost all these farmers (87%) receive inputs on credit as part of the

contract. In all cases, farmers receive fertiliser; in 82%, this is supplemented with seed and 68% receive other products additional to fertiliser.

Table 52 shows that farmers' clients are mainly retailers, traders or middlemen, and wholesalers.

7.12 Value of incremental sales as a result of AGRA (indicator 10)

The value of incremental sales as a result of AGRA cannot be determined yet as only one round of data collection has been completed. Therefore, total revenues from maize sales are reported as a baseline value. Revenues were calculated by multiplying the quantity sold (in kg) by the common price received per kg. Values were converted to kilogrammes in case quantities were reported in different units.

Table 53: Value of incremental sales as a result of AGRA

	All	Male-headed	Female-headed
10. Value of incremental sales as a result of AGRA (crop revenue) (US$)	460.1	465.9	304.2

On average, the revenue from selling maize is US$4,603. Total revenues from maize sales in Nigerian Naira are shown in Table 54. It stands out that revenues are significantly higher for male-headed households.

Table 54: Sales value (total revenue) of maize sold, wet season – calculated variable (IO5.3 – 36) – KIT indicator 10

Revenue from sales of maize, wet season (₦)	All	Male-headed	Female-headed	sig
mean	165861.7	167967.0	109678.1	*
median	117000.0	120000.0	65000.0	
n	886	854	32	

Note: significance from a one-way ANOVA statistical test. ***, **, * indicate significance levels of 1%, 5% and 10% respectively
n = households that sold maize

This difference in revenues is not caused by the price households receive for their maize; households, on average, receive ₦71.8. This price is almost identical between male-headed and female-headed households (see Table 55).

Table 55: Price received for maize (₦)

Common price received for maize (₦/kg), wet season	All	Male-headed	Female-headed	sig
mean	71.7	71.8	70.0	
median	70.0	70.0	70.0	
n	855	828	27	

Note: significance from a one-way ANOVA statistical test. ***, **, * indicate significance levels of 1%, 5% and 10% respectively
n = households that sold maize

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[3] This value is converted from Naira to US$ by using the 2018 average exchange rate of 1US$ = ₦360.52

Instead, the difference arises from quantities. Revenues for male-headed households are higher because they sell larger quantities, on average. Table 56 shows that male-headed families sell higher shares of their harvest; this difference is significant. Since male-headed households produce more maize (as was shown in Section 7.5), male-headed households also sell larger quantities in absolute terms.

Table 56: Allocation of maize harvest to different household uses (percentage of total harvest)

	All	Male-headed	Female-headed	sig
Maize used for consumption (% of harvest), wet season	30%	29%	35%	
Maize kept for seed (% of harvest), wet season	1%	1%	1%	
Maize given away (% of harvest), wet season	13%	13%	13%	
Maize used as payment for inputs (% of harvest), wet season	2%	2%	3%	
Maize bartered or exchanged for goods (% of harvest), wet season	1%	1%	1%	
Maize sold (% of harvest), wet season	47%	47%	40%	*
Post-harvest losses of maize (% of total harvest), wet season	0%	0%	1%	
n	943	909	34	

Note: significance from a one-way ANOVA statistical test. ***, **, * indicate significance levels of 1%, 5% and 10% respectively

Furthermore, the crop value of the harvest of farming households can be calculated, by multiplying the total production by the price per kg. Table 57 shows that the mean crop value amounts to more than ₦ 350,000 (or close to US$982, see Table 58), when households proceeded to selling part of their crop. Due to substantial variations in total crop production between households, the crop value also differs significantly.

Table 57: Crop value (₦) of maize produced

	All	Male-headed	Female-headed
Average value of production in ₦	354,083	356,890	269,434
n = households that sold maize			

Table 58: Crop value (US$) of maize produced

	All	Male-headed	Female-headed
Average value of production in US$	982	989	747
n = households that sold maize			

8 Household-level results: rice in Niger and Kaduna States (2018)

8.1 Sample description

Survey area

Rice households were located in both Niger State and Kaduna State. A total number of 1,012 households were visited. In Niger State, interviews were conducted in six districts: Agaie (7%), Gbako (20%), Lavun (10%), Magama (5%), Shiroro (17%) and Wushishi (7%). Within these districts, 676 households supported by 28 CBAs were visited.

In Kaduna State, interviews were conducted in six districts as well: Giwa (6%), Ikara (2%), Kauru (5%), Kudan (5%), Lere (10%) and Makarfi (5%). Within these districts, a total number of 336 households supported by 17 CBAs were visited. Figure 10 shows the geographical spread of surveyed households.
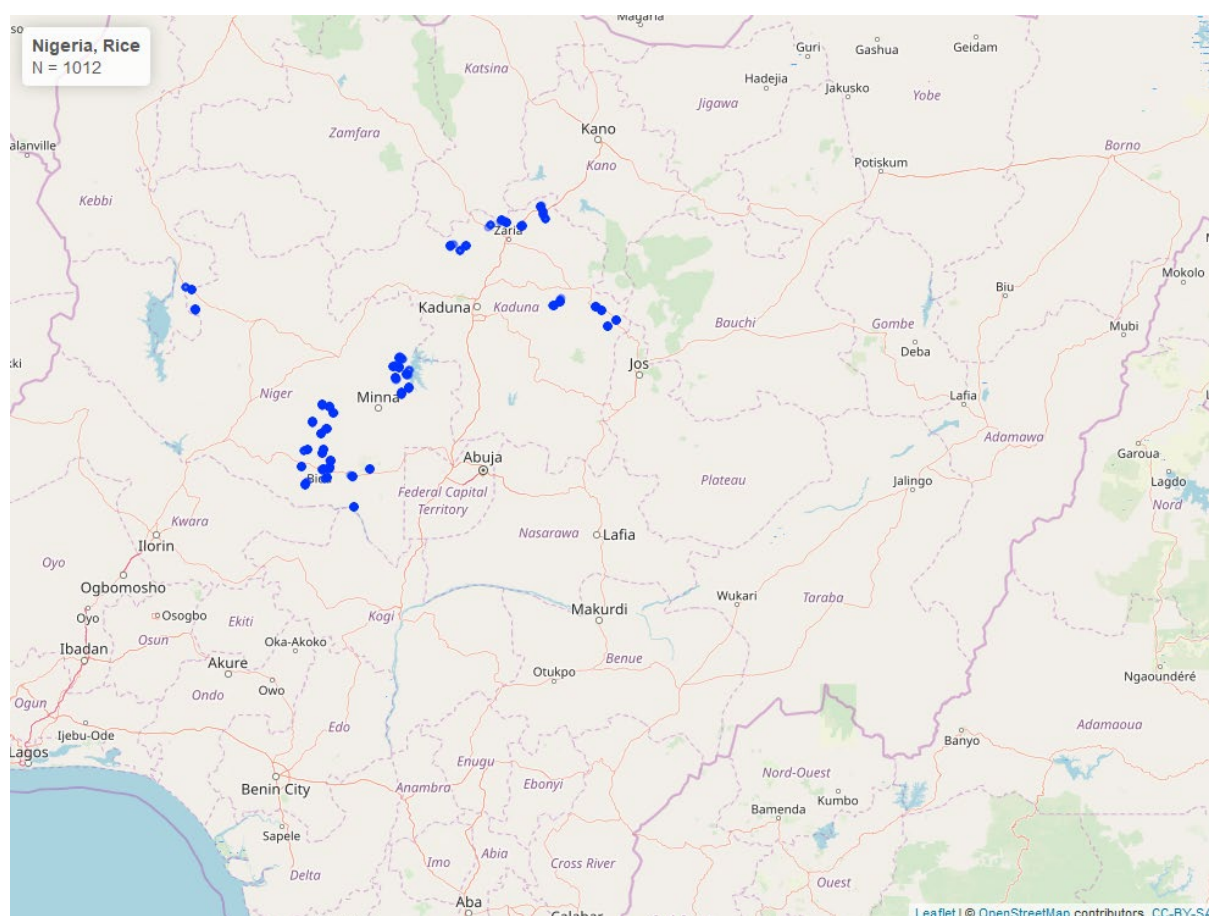
Figure 10: Location of farm household interviews, rice sample

Farm household characteristics

Respondents were all beneficiaries of interventions supported by AGRA. The majority of respondents (82%) were male. In 63% of cases, the beneficiary is also the head of the household. Respondents are, on average, 37 years old (see Figure 11).
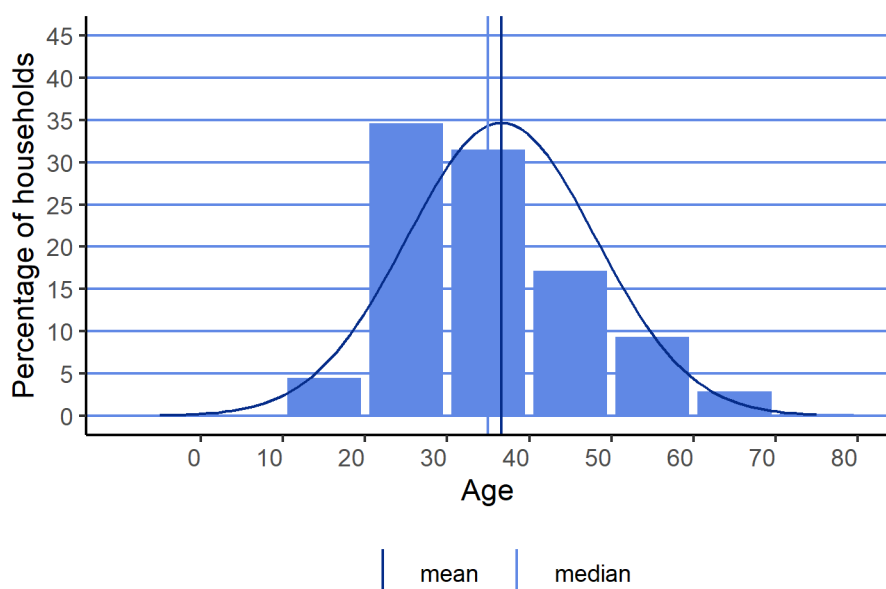
Figure 11: Distribution of respondent age

The share of female-headed households is extremely low: there are only 11 female-headed households in the sample. Nearly all (99%) of sampled households are thus male-headed. Households, on average, consist of 14.2 members, with equal numbers of adults and children (see Table 59).

Table 59: Household composition

Adult/Children	All	Male-headed	Female-headed	sig
Number of children in the household	7.1	7.1	9.3	
Number of adults in the household	7.1	7.1	5.8	
n	1,012	1,001	11	

Note: significance from a one-way ANOVA statistical test. ***, **, * indicate significance levels of 1%, 5% and 10% respectively

Almost all households (97%) own agricultural land. The average amount of land owned is 4.2 ha. Usually, households cultivate all their land. The average amount of cultivated land is 4.7 ha, which means that households also cultivate land that they do not own themselves. Figure 12 shows that 2.0 ha is, on average, used for rice cultivation. The other part of the land is thus used for other crops; besides rice, farmers often cultivate maize, beans, millet or groundnuts.
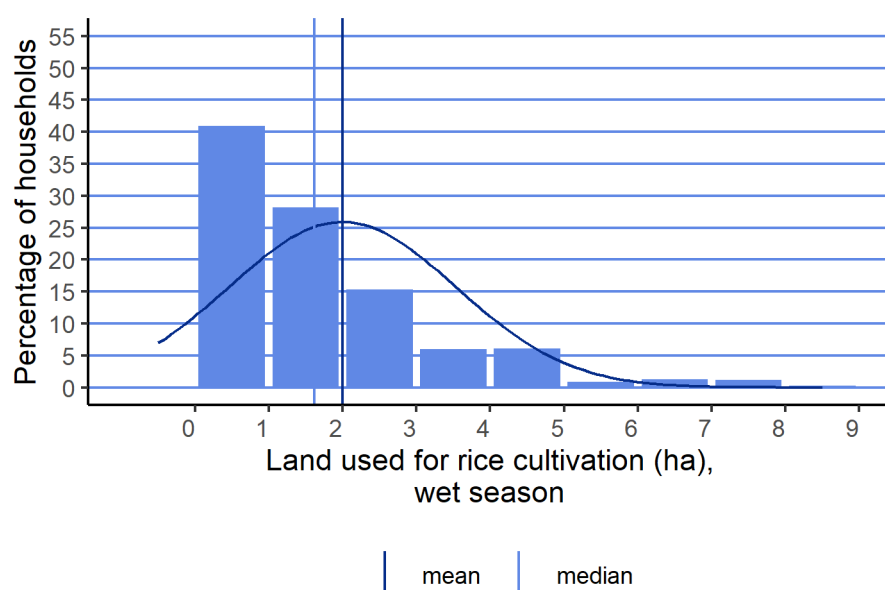
Figure 12: Land allocated to rice (ha), wet season

Nigeria has two farming seasons: the wet season and the dry season. This survey covers the 2018 wet season (May-October 2018) and the 2018 dry season (December 2017-April 2018). Table 60 shows that all the interviewed households cultivated rice in the wet season and that only 1% of households cultivated rice in the dry season. Consequently, this report only presents data for the wet season.

Table 60: Percentage of households producing rice, per season

	All	Male-headed	Female-headed	sig
Wet season	100%	100%	100%	
Dry season	1%	1%	0%	
n	1012	1,001	11	

Note: significance from a one-way ANOVA statistical test. ***, **, * indicate significance levels of 1%, 5% and 10% respectively
Note: Multiple choices possible, therefore total does not need to add to 100%

8.2 Main indicators

Table 61 gives an overview of the primary indicators collected (see Annex 2. Data dictionary of main indicators for definitions for each indicator). The indicators and the underlying behavioural patterns are discussed in further detail in the following sections.

Table 61: Overview of main indicators, rice-farming households

	All	Male-headed	Female-headed
G2: Average number of months of adequate household food provision	**10.8**	**10.8**	**10.5***
G6: Wealth assets index score	**-0.276**	**-0.275**	**-0.372***
G6.1 Share of households in first wealth quintile (%)	5%	5%	0%*

G6.2 Share of households in second wealth quintile (%)	36%	36%	45%*
G6.3 Share of households in third wealth quintile (%)	46%	46%	55%*
G6.4 Share of households in fourth wealth quintile (%)	12%	12%	0%*
G6.5 Share of households in fifth wealth quintile (%)	0%	0%	0%*
IWI International Wealth Index	53.9	53.9	49.2
1. Average yield (kg/ha)	**1905**	**1904**	**1990***
3. Rate of application of target improved technologies or management practices	**97%**	**97%**	**100%***
3.1 Adoption of improved varieties (%)	78%	78%	82%*
3.2 Adoption of endorsed varieties (%)	71%	71%	82%*
3.3 Number of seasons variety is recycled	5.0	5.0	3.9*
3.4 Adoption of endorsed planting practice (%)	62%	62%	45%*
3.5 Adoption of inorganic fertiliser (%)	89%	89%	100%*
3.6 Adoption of endorsed fertiliser (%)	84%	84%	100%*
3.7 Adoption of organic fertiliser (%)	25%	25%	36%*
3.8 Adoption of inoculants (%)	NA	NA	NA
3.9 Adoption of pest-management practices (%)	96%	96%	100%*
3.10 Adoption of endorsed post-harvest practices (%)	96%	96%	100%*
3.11 Adoption of improved storage (%)	1%	1%	0%*
3.12 Use of designated storage facilities (%)	3%	3%	0%*
3.13 Adoption of tablets to preserve quality of recycled seed (%)	28%	28%	27%*
Ha under improved technologies or management practices (%)	**83%**	**83%**	**83%***
3.14 Area under improved varieties (%)	70%	70%	70%*
3.15 Area under inorganic fertiliser (%)	83%	83%	83%*
3.16 Area under pesticides (%)	98%	98%	98%*
4. Access to agricultural advisory extension support services	**64%**	**64%**	**64%***
4.1 Avg. no. of visits per year by agri. advisory extension support services	3.9	3.9	4.0*
4.2 Received small seed pack (%) (additional indicator 4)	NA	NA	NA
4.3 Used small seed pack (%) (additional indicator 4)	NA	NA	NA
4.4 Distance to nearest agro dealer (minutes)	33.0	32.9	43.3*
5. Nitrogen application (kg/ha)	**48.3**	**48.2**	**53.1***
5.1 Phosphorus application (kg/ha)	12.2	12.2	11.1*
5.2 Potassium application (kg/ha)	12.2	12.2	11.1*

Average fertiliser use (Total N + P + K, kg/ha)	**67.8**	**67.8**	**61.6***
6. Percent of post-harvest losses (%)	**1%**	**1%**	**0%***
10. Value of incremental sales as a result of AGRA (crop revenue) (US$)	**484.0**	**486.7**	**236.7***
13. Access to formal financial services (%)	**76%**	**76%**	**91%***
13.1 Bank account (%)	75%	75%	91%*
13.2 Agricultural loan (%)	9%	9%	9%*
13.3 Agricultural insurance (%)	0%	0%	0%*
17. Average age of varieties used (years)	**21.2**	**21.2**	**20.0***
33. Sale through structured trading facilities/arrangements (%)	**3%**	**3%**	**0%***
33.1 Selling to traders/middlemen (%)	44%	44%	36%*
33.2 Selling to consumers (%)	14%	14%	18%*
33.3 Selling to friends/neighbours (%)	3%	3%	9%*
33.4 Selling to aggregation centre (%)	1%	1%	0%*
33.5 Selling to farmer organisation (%)	1%	1%	0%*
33.6 Selling to wholesalers (%)	15%	15%	0%*
33.7 Selling to processors (%)	18%	18%	9%*
33.8 Selling to retailers (%)	31%	31%	45%*
33.9 Selling to company (undefined) (%)	6%	6%	9%*
33.10 Selling to institutional buyers (%)	NA	NA	NA
37. Access to market information through formal channel (%)	**0%**	**0%**	**0%***

The composition of variables can be found in the data dictionary in Annex 2; N might vary across indicators
* indicates that the average has been calculated with less than 50 observations

8.3 Number of Months of Adequate Household Food Provision (indicator G2)

Table 14 reports the average number of months of adequate household food provision (MAHFP). It shows that AGRA-supported farmers have, on average, enough food to meet their family's needs during 10.8 months of the year. There is no statistical difference between male-headed and female-headed households.

Table 62: Average number of months of adequate household food provision (G2)

	All	Male-headed	Female-headed
G2: Average number of months of adequate household food provision	10.8	10.8	10.5*

Figure 13 shows the MAHFP distribution, which shows that 48% of AGRA beneficiaries report having had enough food to meet their family's needs during the entire year. Only 1.7%

of the farmers did not have enough food during six months or more. Only one household reported being chronically food insecure.
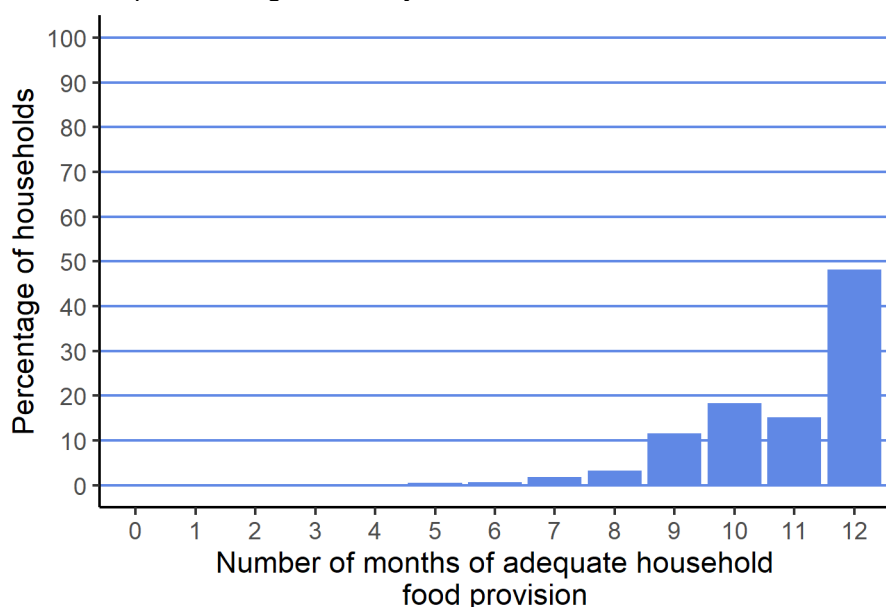
N = 1012

Figure 13: Distribution of number of months of adequate household food provision (G2)

Figure 14 shows the distribution of months with adequate household food provision over the year. The figure shows that food security was lowest in the period June to August. This is in line with expectations, as these months are in the middle of the main cropping season (wet season) and food insecurity is usually highest right before harvest.
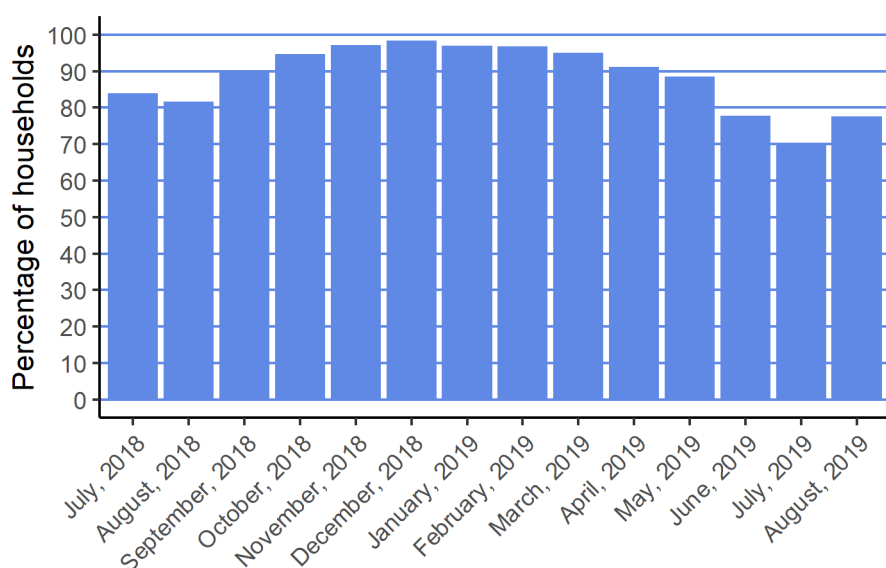
N = 1012

Figure 14: Distribution of months with adequate household food provision

8.4   Wealth asset index score (indicator G6)

Table 63 shows the quintile distribution of the DHS wealth index. The DHS household wealth index is a composite measure of a household's cumulative living standard, which is

composed of data on asset ownership, materials used for housing construction, and types of water access and sanitation facilities. Wealth index scores were compared with the national Nigerian DHS distribution for rural areas to determine a household's relative wealth compared to the country average. As can be seen from Table 63, most households are in the 2nd and 3rd quintiles. Only 5% are in the 1st (poorest) quintile of the country and 0% are in the 5th (wealthiest) quintile.

Table 63: DHS wealth index

	All	Male-headed	Female-headed
G6: Wealth assets index score	**-0.276**	**-0.275**	**-0.372***
G6.1 Share of households in first wealth quintile (%)	5%	5%	0%*
G6.2 Share of households in second wealth quintile (%)	36%	36%	45%*
G6.3 Share of households in third wealth quintile (%)	46%	46%	55%*
G6.4 Share of households in fourth wealth quintile (%)	12%	12%	0%*
G6.5 Share of households in fifth wealth quintile (%)	0%	0%	0%*
IWI International Wealth Index	53.9	53.9	49.2

8.5   Yield (indicator 1)

Yield figures are calculated by dividing the total production by the amount of land under rice cultivation. To enhance data accuracy, respondents were able to answer questions in units of their preference for both production and land size. The preferred units for production were generally bags, while the preferred unit of land size was most often hectares or acres. Respondents were asked to clarify on bag volume to get a good estimation of the amount of rice per bag. Production and land data units were then converted to kilogrammes and hectares. Out of 1,012 interviewed households, nine respondents did not know their rice production, while 15 respondents did not know how much land was used to cultivate rice.

Respondents reported an average rice production of 3,403 kg. Figure 15 shows the distribution of quantity of rice harvested. The figure shows a skewed distribution; due to some high production values, the median is slightly lower (2,500 kg) than the mean.
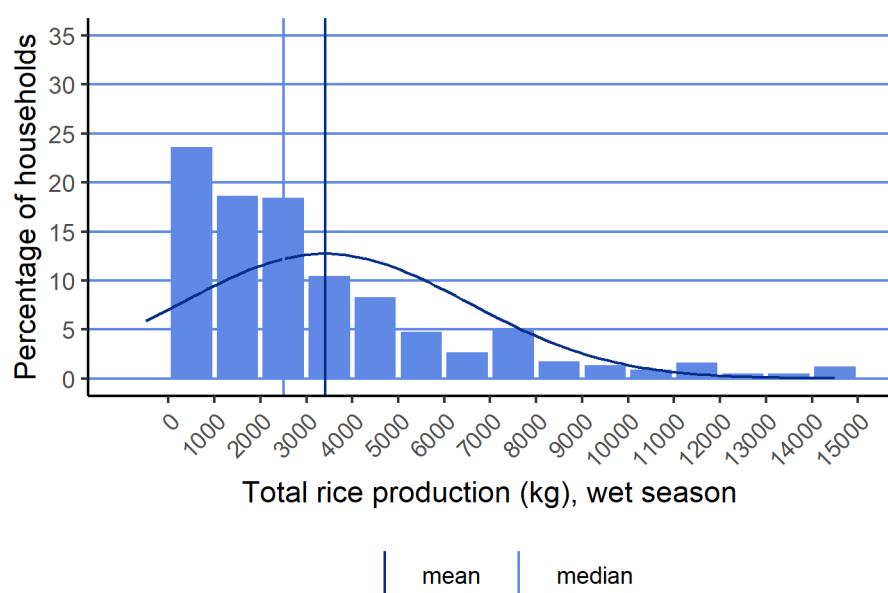
Figure 15: Total production of rice (kg), wet season

Rice yields are, on average, 1,905 kg per ha (see Table 64 and Figure 16). Although female-headed households report slightly higher yields on average, this difference is not statistically significant. This sample average is slightly higher than the Nigerian national average (1.88 t per ha).[4]

Table 64: Average rice yield (kg/ha)

	All	**Male-headed**	**Female-headed**
1. Average yield (kg/ha)	1,905	1,904	1,990*

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[4] Source: http://ricestat.irri.org:8080/wrsv3/entrypoint.htm
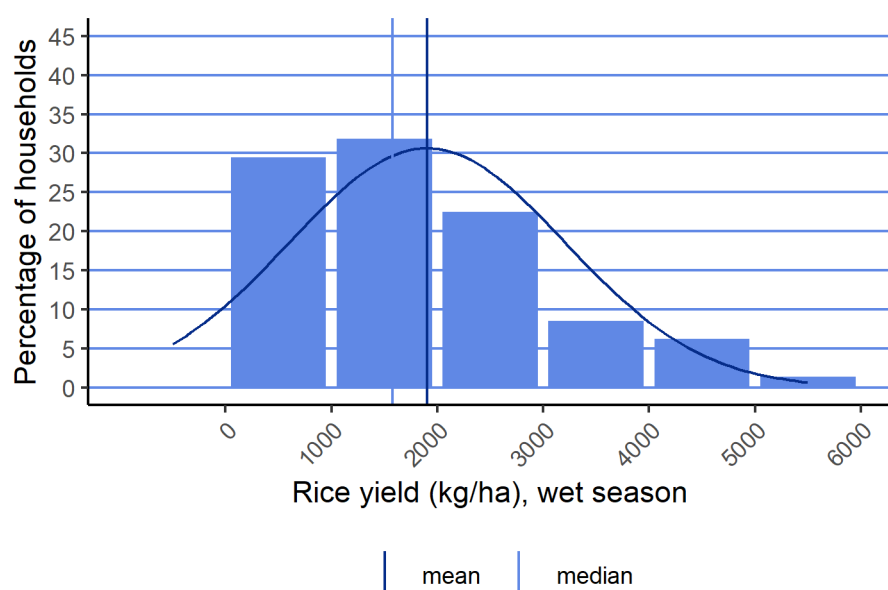
Figure 16: Distribution of average rice yield (kg/ha), wet season

8.6 Rate of application of target improved productivity technologies or management practices (indicator 3, 5, 17)

Improved varieties, recycling and planting practices

Improved varieties
Table 65 shows that 78% of farmers make use of improved rice varieties. AGRA also promotes specific varieties (here referred to as 'endorsed varieties'), which are VSF 3595, VSF 3445, VSF 3605, VSF 3615, VSF3525, Upia1,2&3, Faro 59, Faro 44, Faro 60 & Faro 61 and Nerica 8. In 2018, 71% of farmers used these endorsed varieties (see Table 65).

Table 65: Main indicators for the use of improved varieties, recycling, and planting practices

	All	**Male-headed**	**Female-headed**
3.1 Adoption of improved varieties (%)	78%	78%	82%*
3.2 Adoption of endorsed varieties (%)	71%	71%	82%*
3.3 Number of seasons variety is recycled	5.0	5.0	3.9*
3.4 Adoption of endorsed planting practice (%)	62%	62%	45%*
17 Average age of varieties used (years)	21.1	21.2	20.0*
Ha under improved technologies or management practices (%)	83%	83%	83%*

Table 66 lists the rice varieties grown. It shows that there is large variation in the varieties that are being cultivated. The most popular variety is the promoted FARO-44, an early-maturing lowland variety, followed by UPIA 2 (also promoted).

Table 66: Varieties used (percentage of households per variety), wet season

Varieties	All	Male-headed	Female-headed	sig
FARO-44 (promoted)	52%	52%	55%	
UPIA 2 - Jamila (promoted)	13%	13%	27%	
Other	12%	12%	0%	
FARO-52	8%	8%	9%	
Local variety, unspecified	7%	7%	0%	
FARO 61 - Farin Jollof (promoted)	7%	7%	0%	
Hybrid, unspecified	3%	3%	0%	
Don't know	3%	3%	9%	
FARO-57	2%	2%	0%	
FARO-54	1%	1%	0%	
FARO-59 (promoted)	1%	1%	0%	
Jeep	1%	1%	0%	
2BC	1%	1%	0%	
Emilagi	1%	1%	0%	
NERICA, unspecified	1%	1%	0%	
Waluwe	1%	1%	0%	
Wasila	1%	1%	9%	**
Yar Kura	1%	1%	0%	
n	1009	998	11	

*Note: significance from a one-way ANOVA statistical test. ***, **, * indicate significance levels of 1%, 5% and 10% respectively*
Note: Multiple choices possible, therefore total does not need to add to 100%
Note: Categories smaller than 0.5% are combined in 'Other'

Table 67 groups the varieties that are cultivated in the hybrid, pure line, local variety, or OPV categories, which shows that 8% of farmers have, in fact, cultivated a hybrid variety, and 70% has cultivated a pure line variety. This is considerably higher than national averages. Local variety use is low: only 3% of farmers indicate using a local variety. However, it should be noticed that 19% of varieties used by farmers could not be classified; this is partly caused because of unavailability of information, and partly caused by farmers not knowing exactly which variety they use.

Table 67: Type of main rice variety (percentage of households per type), wet season

Type of main variety, wet season	All	Male-headed	Female-headed	sig
Pure Line	70%	70%	82%	
Not able to classify	19%	19%	18%	
Hybrid	8%	8%	0%	
Local variety	3%	3%	0%	
OPV	0%	0%	0%	
n	1008	997	11	

*Note: significance from a Chi-squared statistical test. ***, **, * indicate significance levels of 1%, 5% and 10% respectively*

The age of varieties is high; on average, it has been 21.1 years since the date of release in Nigeria (see Table 68). Seeds are, on average, recycled for five seasons before they are renewed. This number is consistent for all types of seeds. The source where farmers acquire

their seed differs per variety type. Local varieties are, in all cases, obtained from the field of a community member. Pure line varieties are mostly obtained from agro-dealers, NGOs, or community members. Hybrids are in equal proportions obtained from agro-dealers, NGOs and research institutes.

Table 68: Age of main rice variety (years), wet season

Age of main variety (years), wet season	All	Male-headed	Female-headed	sig
mean	21.2	21.2	20.0	
median	27.0	27.0	27.0	
n	762	753	9	

*Note: significance from a one-way ANOVA statistical test. ***, **, * indicate significance levels of 1%, 5% and 10% respectively*
n = number of varieties of which the age could be classified (local varieties excluded). Age could not be classified for % of varieties.

Table 69 shows a subset of yields per variety type. At first sight, it looks like yield is highest for local varieties; however, this difference is not significant. There is thus no statistically significant difference in yields between variety types. As the size of the hybrid and local variety subsamples is low, additional research would be needed to determine whether this difference is really absent.

Table 69: Average rice yield (kg/ha), by type of variety, wet season

Rice yield (kg/ha), wet season	All	Local variety	OPV	Hybrid	Pure Line	sig
mean	1905.5	2441.3	NA	1966.8	1919.0	
median	1575.0	2224.0	NA	1797.6	1584.4	
n	937	27	0	76	654	

*Note: significance from a one-way ANOVA statistical test. ***, **, * indicate significance levels of 1%, 5% and 10% respectively*

Interestingly, yields are still the most important motivation for farmers to choose hybrid and pure line varieties. Table 70 shows that yields are important factors for all variety types; but yields are significantly more important for hybrid and pure line varieties than for local varieties. On the other hand, maturing time is an important motivation to choose for a local variety.

Table 70: Appreciated traits of the main rice variety used (percentage of households per source) by type of variety, wet season

Rice variety traits	All	Local variety	Hybrid	Pure Line	sig
Yields	88%	74%	80%	92%	***
Maturing time	48%	56%	26%	56%	***
Taste	47%	33%	49%	50%	
Appreciated by buyers (market)	38%	41%	26%	43%	**
Colour	29%	19%	34%	31%	
Processing	20%	11%	15%	22%	
Tolerance to floods	6%	4%	11%	4%	***
Tolerance to droughts	5%	4%	6%	5%	
Price and/or premium from buyers	4%	4%	6%	4%	
Tolerance to pests	3%	4%	4%	3%	
Only variety available	3%	7%	2%	0%	***

Rice variety traits	All	Local variety	Hybrid	Pure Line	sig
Conservation (storage time)	2%	4%	0%	2%	
It's the only variety that I know	2%	0%	0%	1%	
Tolerance to diseases	1%	4%	1%	1%	
Other	3%	7%	2%	2%	
n	1009	27	82	707	

Planting practices

Table 65 shows the percentage of farmers adopting endorsed planting practices. For planting, AGRA promotes using 20 cm by 20 cm spacing, both when dibbling and transplanting. In total, 62% of households use this spacing. Other households use other spacing (25%) or broadcast their seeds (2%) (see Table 71).

Table 71: Spacing used for planting and transplanting of rice, wet season

Spacing used for planting and transplanting, wet season	All	Male-headed	Female-headed	sig
10 by 10	9%	9%	18%	
15 by 15	10%	10%	9%	
20 by 20	62%	62%	45%	
25 by 25	0%	0%	0%	***
30 by 30	6%	6%	0%	
Random spacing due to broadcasting	2%	2%	9%	
Other	1%	1%	9%	
Don't know	10%	10%	9%	
n	1009	998	11	

Note: significance from a Chi-squared statistical test. ***, **, * indicate significance levels of 1%, 5% and 10% respectively

Table 72 shows the sowing methods farmers use. Drilling – releasing seeds continuously in a row while moving forward at a uniform speed – is the most popular practice and is applied by 55% of farmers. Dibbling – dropping seed in small holes – is applied by 28% of farm households. Around 17% of farm households manually broadcast their seeds.

Table 72: Sowing method for rice, wet season

Sowing method, wet season	All	Male-headed	Female-headed	sig
Broadcasting by hand	17%	17%	18%	
Broadcasting with funnel	0%	0%	0%	
Drilling	55%	56%	45%	
Dibbling	28%	28%	36%	
Other	0%	0%	0%	
n	1009	998	11	

Note: significance from a Chi-squared statistical test. ***, **, * indicate significance levels of 1%, 5% and 10% respectively

Half of farmers transplant their rice (Table 73). Of these farmers, 75% initially planted rice in a nursery. Around 23% planted it in-field and transplanted it to another field later.

Table 73: Transplanting of rice, wet season

Household transplanted the rice, wet season	All	Male-headed	Female-headed	sig
mean	50%	50%	36%	
n	1,008	997	11	

Note: significance from a one-way ANOVA statistical test. ***, **, * indicate significance levels of 1%, 5% and 10% respectively

Fertiliser use

Table 74 presents the main indicators on fertiliser use. A large majority of farmers (89%) apply inorganic fertiliser. Farmers that apply fertiliser typically do this on almost all their cultivated land. In total, 84% of all rice land gets applied with fertilisers.

Table 74: Main indicators for the adoption and use of fertilisers

	All	Male-headed	Female-headed
3.5 Adoption of inorganic fertiliser (%)	89%	89%	100%*
3.6 Adoption of endorsed fertiliser (%)	84%	84%	100%*
3.7 Adoption of organic fertiliser (%)	25%	25%	36%*
3.15 Area under inorganic fertiliser (%)	84%	84%	84%*
5. Nitrogen application (kg/ha)	48.3	48.2	53.1*
5.1 Phosphorus application (kg/ha)	12.2	12.2	11.1*
5.2 Potassium application (kg/ha)	12.2	12.2	11.1*
Average fertiliser use (Total N + P + K, kg/ha)	67.8	67.8	61.6*

In Nigeria, AGRA promotes urea. With 84% of farmers applying this fertiliser, uptake is high. NPK is also commonly used (92%). The most popular NPK formulas are NPK 15-15-15 (77%) and NPK 20-10-10 (21%).

On average, urea users apply 93.7 kg of urea per ha. NPK application is, on average among NPK users, 107.7 kg/ha. Male-headed households generally apply more fertiliser per land unit than female-headed households, but this difference is not statistically significant.

Among all households interviewed, nitrogen is the macronutrient applied in the largest quantity (48.2 kg/ha), followed by potassium and phosphorous (both 12.2 kg/ha). No surveyed farmer applies secondary macronutrients or micronutrients (see Table 75).

Table 75: Nutrients applied for rice (kg/ha), wet season

	All	Male-headed	Female-headed	sig
Nitrogen application (kg/ha), wet season	48.2	48.2	53.1	
Phosphorus application (kg/ha), wet season	12.2	12.2	11.1	
Potassium application (kg/ha), wet season	12.2	12.2	11.1	
Sulphur application (kg/ha), wet season	0.0	0.0	0.0	
Calcium application (kg/ha), wet season	0.0	0.0	0.0	

	All	Male-headed	Female-headed	sig
Magnesium application (kg/ha, wet season	0.0	0.0	0.0	
Zinc application (kg/ha, wet season	0.0	0.0	0.0	
n	953	944	9	

Note: significance from a one-way ANOVA statistical test. ***, **, * indicate significance levels of 1%, 5% and 10% respectively
n = households that cultivated rice

Common sources of information on fertiliser types are observation in the community (51%) and NGO extension services (17%). The majority of households has been using fertilisers for four to five years.

A quarter of households use organic fertiliser. In almost all cases (92%), organic fertiliser consists of manure, sometimes supplemented by compost (14%) or crop residues (4%) (see Table 76). Information on organic fertilisers mainly comes from traditional knowledge; 66% of farmers obtain information on organic fertiliser from other people in their household or the community and 26% are self-educated. Only 8% got the information from sources outside the community. The large majority of farmers has used organic fertiliser for longer than five years.

Table 76: Types of organic fertiliser used for rice

Types of organic fertiliser	All	Male-headed	Female-headed	sig
Granular	0%	0%	0%	NA
Compost	14%	14%	25%	
Manure	92%	92%	75%	
Crop residues	4%	4%	0%	
n	256	252	4	

Note: significance from a one-way ANOVA statistical test. ***, **, * indicate significance levels of 1%, 5% and 10% respectively
Note: Multiple choices possible, therefore total does not need to add to 100%
n = households that applied organic fertiliser

Differences in productivity between farmers who apply fertiliser and farmers who do not are large. In line with expectations, yields are significantly higher amongst farm households that apply fertilisers (see Table 77).

Table 77: Average rice yield (kg/ha), by fertiliser use (yes/no), wet season

Rice yield (kg/ha), wet season	All	No	Yes	sig
mean	1905.5	1285.2	1976.3	***
median	1575.0	1065.7	1666.7	
n	937	96	841	

Note: significance from a one-way ANOVA statistical test. ***, **, * indicate significance levels of 1%, 5% and 10% respectively

Pest management practices
Table 78 shows the percentage of households who have adopted pest management practices. Adoption of pest-management practices is defined as the percentage of households applying pesticides, herbicides and/or fungicides. Herbicides are used most, followed by pesticides (see Table 79); only 3% of households use fungicides.

Table 78: Adoption of pest-management practices

	All	Male-headed	Female-headed
3.9 Adoption of pest-management practices (%)	96%	96%	100%*

Table 79: Percentage of households applying agro-chemical inputs for rice, wet season

	All	Male-headed	Female-headed	sig
Pesticide application, wet season	51%	51%	55%	
Herbicide application, wet season	96%	96%	100%	
Fungicide application, wet season	3%	3%	0%	
n	1009	998	11	

Note: significance from a one-way ANOVA statistical test. ***, **, * indicate significance levels of 1%, 5% and 10% respectively

Most farmers who apply agro-chemicals, apply them on all their land. Consequently, 47% of the total land area is treated with pesticides and 91% is treated with herbicides (see Table 80). Fungicides are applied on only 2% of the cultivated land.

Table 80: Percentage of total land used for rice cultivation under agro-chemical inputs, wet season

	All	Male-headed	Female-headed	sig
Percentage of total land area under pesticides, wet season	47%	47%	54%	
Percentage of total land area under herbicides, wet season	91%	91%	100%	
Percentage of total land area under fungicides, wet season	2%	2%	0%	
n	1012	1,001	11	

Note: significance from a one-way ANOVA statistical test. ***, **, * indicate significance levels of 1%, 5% and 10% respectively

From all pesticide types, DD force is most popular (applied by 30% of pesticide users). Other pesticide types are applied by a small number of households. However, survey results show that most farmers (74%), in fact, use other types of pesticides besides those listed (see Table 81). Information on pesticides is most often obtained from other community members (47%); 13% of farmers obtain information from their CBA.

Table 81: Type of pesticides applied for rice (percentage of households per type), wet season

Types of pesticides	All	Male-headed	Female-headed	sig
Titan	1%	1%	0%	
Benefit	2%	2%	0%	
DD Force	30%	30%	33%	
Emmemictine	0%	0%	0%	
Other	74%	74%	67%	
n	510	504	6	

Note: significance from a one-way ANOVA statistical test. ***, **, * indicate significance levels of 1%, 5% and 10% respectively
Note: Multiple choices possible, therefore total does not need to add to 100%
Note: Categories smaller than 0.1% are combined in 'Other'
n = households that applied pesticides

In almost all cases (98%), farmers apply herbicides before weeds emerge. A large majority of farm households (67%) also apply herbicides pre-emergence (see Table 82). AGRA endorses both pre-emergence and post-emergence herbicide application. In addition to herbicide use, 93% of households practise weeding. On average, people carry out weeding two times per season.

Table 82: Timing of herbicide application for rice, wet season

	All	Male-headed	Female-headed	sig
Pre-emergence (promoted)	98%	97%	100%	
Post-emergence (promoted)	67%	67%	82%	
n	965	954	11	

Note: significance from a one-way ANOVA statistical test. ***, **, * indicate significance levels of 1%, 5% and 10% respectively
Note: Multiple choices possible, therefore total does not need to add to 100%
n = households that applied herbicides

Post-harvest practices

Table 83 shows the main indicators on the post-harvest practices endorsed by AGRA with the purpose of minimising post-harvest losses. Various post-harvest practices are captured in four indicators. The adoption of endorsed post-harvest practices (indicator 3.10) is defined as the use of a sheet or tarpaulin at least once during rice processing (drying and threshing). The adoption of improved storage facilities (indicator 3.11) measures the percentage of farmers storing rice in silos or double liner hermetic storage bags (such as PICS bags). Farm households use designated storage facilities (indicator 3.12) when they store rice at farmer's organisations, private storage facilities, or through the warehouse receipt systems.

Table 83: Main indicators for the adoption of improved post-harvest practices

	All	Male-headed	Female-headed
3.10 Adoption of endorsed post-harvest practices (%)	96%	96%	100%*
3.11 Adoption of improved storage (%)	1%	1%	0%*
3.12 Use of designated storage facilities (%)	3%	3%	0%*
3.13 Adoption of tablets to preserve quality of recycled seed (%)	28%	28%	27%*

Almost all farmers (96%) use a tarpaulin at least once during processing. Table 84 shows that 68% of households use a tarpaulin when drying rice. This practice is promoted by AGRA. In most cases (69%), households learned about tarpaulin use from observation in the community. Three quarters of the households that use a tarpaulin have been doing so for more than four years.

Table 84: Use of sheeting for drying rice, wet season

Used a sheet/tarpaulin for drying rice, wet season	All	Male-headed	Female-headed	sig
mean	68%	68%	73%	
n	1009	998	11	

Note: significance from a one-way ANOVA statistical test. ***, **, * indicate significance levels of 1%, 5% and 10% respectively

AGRA also promotes the use of mechanised threshing. However, only 2% of farmers engage in this practice. Almost all farmers thus thresh their rice manually. Tarpaulin use is higher for threshing rice: among the households that manually thresh rice, tarpaulin use during threshing was 96% (see Table 85). Again, the household's main source of information on tarpaulin use is observation in the community (76%); 91% of households that use tarpaulins for threshing have been doing so for over four years.

Table 85: Use of sheeting when threshing rice, wet season

Used a sheet/tarpaullin for threshing rice, wet season	All	Male-headed	Female-headed	sig
mean	96%	96%	100%	
n	994	983	11	

Note: significance from a one-way ANOVA statistical test. ***, **, * indicate significance levels of 1%, 5% and 10% respectively

Although promoted, the uptake of improved storage facilities is very low. Only 1% of households use improved storage facilities, such as silos or double liner hermetic storage bags (such as PICS bags). Table 86 shows that only 1% of households use PICS bags to store their rice; none of the farm households use silos to store rice.

Table 86: Percentage of households using PICS bags for storage of rice, wet season

Used PICS bags for storing rice, wet season	All	Male-headed	Female-headed	sig
mean	1%	1%	0%	
n	1009	998	11	

Note: significance from a one-way ANOVA statistical test. ***, **, * indicate significance levels of 1%, 5% and 10% respectively

While the use of improved storage facilities is low, the use of preservative tablets that prevent losses in the rice stock is a bit higher. Table 87 shows that 28% of farmers use tablets that prevent quality loss of their seed stock.

Table 87: Use of preservative tablets for rice seeds, wet season

Usage of preservative tablets, wet season	All	Male-headed	Female-headed	sig
mean	28%	28%	27%	
n	889	878	11	

Note: significance from a one-way ANOVA statistical test. ***, **, * indicate significance levels of 1%, 5% and 10% respectively

Besides stocking rice with the purpose of personal consumption later, rice can also be stocked for the purpose of selling it later (when prices are higher); around 39% of farm households stock rice for this purpose. On average, households stocked 446 kg. The percentage of households using designated storage facilities is low. Nearly all households (98%) stock rice in their own storage facilities (Table 88). Only 4% use a rented private storage facility, while 3% stock at the farmer organisation. None of the farm households make use of a warehouse receipt system.

Table 88: Type of storage used for rice, wet season

	All	**Male-headed**	**Female-headed**	**sig**
Own storage	98%	98%	100%	
Farmer organisation storage	3%	4%	0%	
Warehouse receipt system	0%	0%	0%	NA
Private storage rental	4%	4%	0%	
n	403	397	6	

Note: significance from a one-way ANOVA statistical test. ***, **, * indicate significance levels of 1%, 5% and 10% respectively
Note: Multiple choices possible, therefore total does not need to add to 100%

8.7   Access to agricultural advisory extension support services (indicator 4)

Access to agricultural advisory extension support services is defined as the percentage of households that interacted with an agricultural extension officer during the last 12 months. During these months, 64% of households were visited by an agricultural extension officer (see Table 89). On average, households that met with an extension officer were visited between three and four times.

Table 89: Main indicators for access to agricultural advisory support services

	All	**Male-headed**	**Female-headed**
4. Access to agricultural advisory extension support services	64%	64%	64%*
4.1 Average number of visits per year by agricultural advisory extension support services	3.9	3.9	4.0*
4.2 Received small seed pack (%) (additional indicator 4)	NA	NA	NA
4.3 Used small seed pack (%) (additional indicator 4)	NA	NA	NA
4.4 Distance to nearest agro dealer (minutes)	33.0	32.9	43.3*

Table 90 shows that extension officers were most often affiliated with the Nigerian government (74%), followed by NGOs (52%). Around 31% of extension agents were CBAs. All female-headed households were visited by extension agents affiliated with NGOs.

Table 90: Affiliation of extension service provider (percentage of households per provider)

Type	All	Male-headed	Female-headed	sig
Government	74%	74%	86%	
Company	15%	15%	14%	
NGO	52%	51%	100%	**
Farmer promoter/VBA	31%	30%	57%	
Don't know	2%	2%	0%	
Other	0%	0%	0%	
n	651	644	7	

Note: significance from a one-way ANOVA statistical test. ***, **, * indicate significance levels of 1%, 5% and 10% respectively
Note: Multiple choices possible, therefore total does not need to add to 100%
Note: Categories smaller than 1% are combined in 'Other'

The extension method that is most common is the use of a demonstration plot (see Table 91): 44% of farmers indicated having engaged in demonstrations. Farmer field schools, technology packages and support by CBAs were mentioned by 33%, 18% and 9% of the farmers, respectively.

Table 91: Type of extension method used (percentage of households per method)

Method	All	Male-headed	Female-headed	sig
Demonstration plot	44%	44%	27%	
None	39%	39%	45%	
Farmer Field Schools	33%	33%	27%	
Technology packages	18%	18%	0%	
Support by farmer promoter	9%	10%	0%	
Mentoring by lead farmers	7%	7%	0%	
Transfer of knowledge within farmer organisation/Training of trainers	5%	6%	0%	
Don't know	2%	2%	9%	
Other	0%	0%	0%	NA
n	1011	1000	11	

Note: significance from a one-way ANOVA statistical test. ***, **, * indicate significance levels of 1%, 5% and 10% respectively
Note: Multiple choices possible, therefore total does not need to add to 100%
Note: Categories smaller than 1% are combined in 'Other'

Another aspect of advisory extension services is the distribution and use of promotional seed packs, but this is not applicable in the case of Nigeria, since no rice seed packs were distributed.

Access to agricultural extension services also includes distance to the nearest agro-dealer. Distance to agro-dealers is measured based on travel time; as can be seen in Table 92, average travel time is 33 minutes. There is a significant difference in travel time between the two regions. Rice-producing households in Kaduna indicate travelling, on average, 22 minutes to reach an agro-dealer (similar to maize farmers in the same region). Households in the Niger region, on the other hand, travel significantly longer: on average 37 minutes. Barriers to obtaining inputs for rice farmers in Niger are therefore higher (due to investment of time and travel costs) than households in Kaduna. When visiting the agro-dealer, households most often travel by motorbike (66%), by foot (17%) and by car (15%).

Table 92: Average travel time to agro-dealer (minutes)

Distance to agro-dealer in minutes	All	Male-headed	Female-headed	sig
mean	33.0	32.9	43.3	
median	30.0	30.0	30.0	
n	847	838	9	

Note: significance from a one-way ANOVA statistical test. ***, **, * indicate significance levels of 1%, 5% and 10% respectively

8.8   Access to formal financial services (indicator 13)

Table 93 shows that 76% of surveyed households have access to formal financial services. This means that 76% of households has access to at least one bank account, formal agricultural loan, or agricultural insurance. This indicator only includes access to formal financial services (provided by formal financial institutions), and excludes access to informal

financial services, such as services provided by village money lenders, relatives, or saving groups.

Table 93: Main indicators for access to formal financial services

	All	**Male-headed**	**Female-headed**
13. Access to formal financial services (%)	76%	76%	91%*
13.1 Bank account (%)	75%	75%	91%*
13.2 Agricultural loan (%)	9%	9%	9%*
13.3 Agricultural insurance (%)	0%	0%	0%*

The financial service that is used most is (by far) a bank account: 75% of households have a bank account. Only 9% of farmers took a loan through a formal arrangement (banks, microfinance institutions, savings and credit cooperatives or mobile money). However, in total, 34% of farmers took a loan in 2018. These observations confirm the previous statements that access to credit, especially formal credit, is a constraint for many rural farm households in Nigeria. No farmer had agricultural insurance in 2018.

Table 94 shows the types of loan providers. It shows that that only 26% of loans are provided by formal financial institutions (SACCO, bank or MFI). Most common are loans from family or friends (56%) and village money lenders (26%). The table also shows that female-headed households more often took up loans from a cooperative, but as only four female-headed households answered the question, this number is not very representative.

Table 94: Types of loan providers (percentage of households per provider)

Loan providers	All	Male-headed	Female-headed	sig
Family or friends	56%	56%	50%	
Village money lender	26%	26%	25%	
Savings and Credit Cooperative (SACCO)/Credit Union	10%	10%	25%	
Bank	10%	10%	0%	
Microfinance institution (MFI)	6%	6%	0%	
Cooperative	2%	1%	25%	***
Trader	1%	1%	0%	
Other	3%	3%	0%	
n	347	343	4	

*Note: significance from a one-way ANOVA statistical test. ***, **, * indicate significance levels of 1%, 5% and 10% respectively*
Note: Multiple choices possible, therefore total does not need to add to 100%
Note: Categories smaller than 1% are combined in 'Other'
Excluding households that did not take loans

8.9 Post-harvest losses (indicator 6)

Post-harvest losses are measured by the rice that was lost after harvesting (i.e. at farm level) as a share of total production.

Table 95: Main indicator for post-harvest losses

	All	**Male-headed**	**Female-headed**
6. Percent of post-harvest losses (%)	1%	1%	0%*

Table 95 shows that post-harvest losses are, on average, 1% of total harvest. The majority of the sample (77%) did not lose any rice post-harvest. The households that did lose part of their harvest lost, on average, 75 kg of rice. While interpreting this data, it should be kept in mind that post-harvest losses are typically difficult to estimate for farmers, as losses are typically not measured. Other studies have calculated post-harvest losses for rice in Nigeria of around 19-38% (AGRA, 2014; GIZ, 2014).

8.10 Access to market information (indicator 37)

The percentage of households that has access to formal channels of market information (SMS, radio, television, internet and the farmer's organisation) is 0% (see Table 96). That means that no farmer received official market information and reliable information provision remains a major challenge for rice farming households.

Table 96: Main indicator for access to market information

	All	**Male-headed**	**Female-headed**
37. Access to market information through formal channel (%)	0%	0%	0%*

Farmers do, however, often use informal channels to collect market information. Table 97 shows that farmers mainly indicate receiving market information on the market itself (87%), and, to a lesser extent, from other farmers (31%) and from their buyer (22%). A note should be made that this information (compared to formal price information) is more likely to be imperfect, to the disadvantage of the selling household.

Table 97: Sources of market information used by farmers (percentage of households per source)

Source of market information	All	Male-headed	Female-headed	sig
Market	87%	87%	100%	
Farmer to farmer	31%	31%	36%	
Buyer	22%	22%	9%	
Other	2%	2%	0%	
n	932	921	11	

*Note: significance from a one-way ANOVA statistical test. ***, **, * indicate significance levels of 1%, 5% and 10% respectively*
Note: Multiple choices possible, therefore total does not need to add to 100%
Note: Categories smaller than 1% are combined in 'Other'

8.11 Sales channels (indicator 33)

Table 98 shows the main indicators for farmers' sales channels. It includes information on sale through structured trading facilities or arrangements, as well as information on farmers' clients.

Table 98: Main indicators on farmers' sales channels

	All	Male-headed	Female-headed
33. Sale through structured trading facilities/arrangements (%)	3%	3%	0%*
33.1 Selling to traders/middlemen (%)	44%	44%	36%*
33.2 Selling to consumers (%)	14%	14%	18%*
33.3 Selling to friends/neighbours (%)	3%	3%	9%*
33.4 Selling to aggregation centre (%)	1%	1%	0%*
33.5 Selling to farmer organisation (%)	1%	1%	0%*
33.6 Selling to wholesalers (%)	15%	15%	0%*
33.7 Selling to processors (%)	18%	18%	9%*
33.8 Selling to retailers (%)	31%	31%	45%*
33.9 Selling to company (undefined) (%)	6%	6%	9%*
33.10 Selling to institutional buyers (%)	NA	NA	NA

A farm household is considered as selling through a structured trading facility when they sell at least part of their harvest through a formal contract and when they know who the buyers will be at the time of planting. Only 3% of farmers sold their harvest under a formal contract. About one-third of these farmers receive inputs on credit as part of the contract. Farmers generally receive fertiliser (86%), seed (42%) and other products (42%).

Table 98 shows that farmers' clients are mainly traders or middlemen, retailers and processors.

8.12   Value of incremental sales as a result of AGRA (indicator 10)

The value of incremental sales as a result of AGRA cannot be determined yet as only one round of data collection has been completed. Therefore, total revenues from rice sales are reported as a baseline value. Revenues were calculated by multiplying the quantity sold (in kg) by the common price received per kg. Values were converted to kilogrammes in case quantities were reported in different units. On average, the revenue from selling rice is US$484 per farm household.[5]

Table 99: Value of incremental sales as a result of AGRA

	All	Male-headed	Female-headed
10 Value of incremental sales as a result of AGRA (crop revenue) (US$)	484.0	486.7	236.7

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[5] This value is converted from ₦ to US$ by using the 2018 average exchange rate of 1US$ = ₦360.52

Generally, farmers sell 48% of their total harvest. The remainder is used for other purposes, such as consumption (23%), donations (10%) or seed (5%) (see Table 100). When selling, households on average receive ₦103 for a kg of rice (see Table 101).

Table 100: Allocation of rice harvest (%)

	All	Male-headed	Female-headed	sig
Rice used for consumption (% of harvest), wet season	23%	23%	21%	
Rice kept for seed (% of harvest), wet season	6%	6%	11%	**
Rice given away (% of harvest), wet season	10%	10%	9%	
Rice used as payment for inputs (% of harvest), wet season	3%	3%	2%	
Rice bartered or exchanged for goods (% of harvest), wet season	1%	1%	1%	
Rice sold (% of harvest), wet season	48%	48%	46%	
Post-harvest losses of rice (% of total harvest), wet season	1%	1%	0%	
n	968	957	11	

*Note: significance from a one-way ANOVA statistical test. ***, **, * indicate significance levels of 1%, 5% and 10% respectively*

Table 101: Price received for rice (₦/kg)

Common price received for rice (₦/kg), wet season	All	Male-headed	Female-headed	sig
mean	103.3	103.3	98.2	
median	100.0	100.0	106.7	
n	873	863	10	

*Note: significance from a one-way ANOVA statistical test. ***, **, * indicate significance levels of 1%, 5% and 10% respectively*
n = households that sold rice

Total revenues from rice sales in Nigerian Naira are shown in Table 102. The large difference between the mean and median stands out here: the revenues are subject to some high (yet not unlikely) values, for which reason the median sales value is only ₦110,250 (US$306).

Table 102: Sales value (total revenue) of rice sold, wet season – calculated variable (IO5.3 – 36) – KIT indicator 10

Revenue from sales of rice, wet season (₦)	All	Male-headed	Female-headed	sig
mean	174,486.8	175,479.4	85,350.0	
median	110,250.0	111,800.0	80,000.0	
n	908	898	10	

*Note: significance from a one-way ANOVA statistical test. ***, **, * indicate significance levels of 1%, 5% and 10% respectively*
n = households that sold rice

The total crop value is calculated by multiplying households' production by the price of kg received. The average crop value lies at ₦377,063 (Table 103), which equates to US$1,045 (Table 104). Variations between households are high.

Table 103: Crop value (₦) of rice produced

	All	Male-headed	Female-headed
Average value of rice production in Naira	377,063	379,107	206,000*

Note: n = households that sold rice

Table 104: Crop value (US$) of rice produced

	All	Male-headed	Female-headed
Average value of rice production in US$	1,045	1051	517*

Note: n = households that sold rice

Part III: Small and medium enterprise survey

9 SME performance survey

9.1 Introduction

AGRA considers small and medium-sized enterprises (SMEs) as important drivers of growth, and they account for up to 90% of all businesses in sub-Saharan African markets. In many agricultural commodity value chains, SMEs also take up many of the downstream activities of processing, storage, transportation, wholesale and retail that are necessary to send farmers' produce to the end market.

An important pathway for change in the PIATA programme is supporting the development of SMEs operating in, and providing support services to, agricultural value chains. AGRA works to stimulate both demand and supply sides of technical assistance and financial products for SMEs.

Core interventions focus on:
- Identifying high-potential SMEs and supporting them with business and technical advisory services to scale up operations. These advisory services involve a performance-based model for service providers. The model requires them to produce business plans and achieve results through effective support to SMEs.
- Matching grants for emergence of medium-sized aggregation/storage businesses in under-served areas where smallholder farmers are increasing their yields, and marketing greater surpluses.
- Providing access to working capital finance for SMEs.
- AGRA influences the ecosystem within which SMEs operate by supporting the development of business, enabling goods and services such as packaging, commodity handling and processing machinery, as well as payment processing services and market data.

To assess the changes in performance of SMEs benefitting from the AGRA-PIATA programme, a rapid survey instrument has been designed, and the baseline data collection was implemented and is reported here.

In the design of the monitoring tool the following needs were taken into consideration:
- A rapid and affordable tool to monitor SME performance;
- A tool which can be tailored to different SMEs, but still allow comparison and use across very different types SMEs;
- A tool which can be used for very different sizes of SMEs, including micro enterprises;
- A tool which can monitor change of performance of SMEs over time;
- A tool which can offer an immediate overview of SME performance;
- A tool which is simple, open access, and can be implemented across countries by enumerators with a reasonable level of education.

To answer all these demands, KIT has developed a simple SME performance scorecard.

9.2 Methodology

Performance dimensions

This scorecard for SME performance is based on monitoring four dimensions:

- Business resilience indicates the ability of the SME to adapt to disruptions while maintaining business operations, employment and assets. The variables used to determine business resilience are:
  - Years in business
  - Number of services provided
  - Diversity of clients
- Financial stability indicates the financial health and access to financial services of an SME. The variables used to determine financial stability are:
  - Estimated annual turnover
  - Proportion of capital need covered with formal credit
  - Capital investments made over the last three years
- Human capital indicates the education level and gender diversity of the SME workforce. The variables used are:
  - The proportion of staff having received a form of tertiary education
  - The proportion of staff with a permanent contract
  - The proportion of casual workers
  - The proportion of women among staff with a permanent contract
- Technology/assets indicates the SME assets and investments in R&D. The variables used are:
  - Investments in R&D
  - Value of buildings
  - Value of equipment

For all of the above indicators, four levels are predefined, either numeric or descriptive, representing progression, with 1 being the lowest score and 4 being the highest score. In a way, the highest level represents what could be considered the desired state of the SME for the particular variable. The average of the scores gives the total score for each dimension. Performance scorecards are presented in Annex 3. An overview of all SME indicators and associated descriptive statistics is presented in Annex 4.

Sampling

Sampling was done among SMEs benefitting from AGRA support only. This has been done for the practical reason that SMEs not benefitting are not expected to be willing to answer questions about the performance of their enterprise. Also, the objective is monitoring the performance improvement of SMEs receiving support from AGRA, over time.

The targeted sample in each country consisted of:
- 10 commercial seed producers;
- 5 seed companies;
- 10 traders;
- 10 processors;
- 10 agro-dealers;
- 5 input supply companies.

Sampling was done randomly from a list of SMEs provided by AGRA, which was validated with the local AGRA team. The sample distribution of types of SMEs was only considered a guideline, and adapted based on the investment portfolio of AGRA in each country.

In Nigeria, 36 SMEs participated in the survey:
- 5 seed producers;
- 7 seed companies;
- 6 agro-dealers for input supply;
- 8 input supply companies;
- 10 aggregators/traders/processors.

However, the performance of the five commercial seed producers is not reported upon since they provided very incomplete information during the interviews. More information on the SMEs participating in the interviews can be found in Annex 5.

Overall, the survey received limited enthusiasm from the SMEs and a low response rate. A number of SMEs decided not to provide answers to questions perceived as sensitive in the survey.

9.3   Performance dashboard

This section summarises the performance of the different types of SMEs on each of the four dimensions: business resilience, financial stability, human capital and technology. A red bar indicates poor performance (score 1-2); an orange bar indicates that there is room for improvement (score 2-3); while green indicates good performance (score 3-4).

Seed companies

Seven seed companies were surveyed in Nigeria. The summary results are presented in Figure 17 and signal a positive pathway toward good performance. These SMEs are relatively young enterprises and have been in business for just under four years on average (Table 109 in Annex 4). They have an average annual turnover of more than US$930,000. All of them engage in the production of improved/certified seed but production of EGS is also widespread (Table 112 in Annex 4). Variety development is less common. The companies sell their products to different types of clients, including (government) programmes, farmer organisations, traders and wholesalers. Many of the seed companies have invested in buildings/storage and equipment upgrading over the past three years, followed by investments in R&D and staff (training) (Table 113 in Annex 4). Investments have been facilitated by good access to formal credit. Seed companies employ 49 permanent and 70 casual staff, on average. Female staff are clearly a minority (Table 110 in Annex 4).
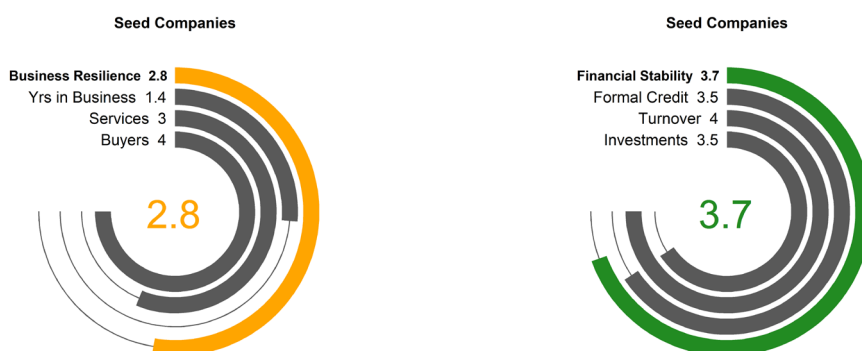
Figure 17: Seed companies' performance scorecard

Agro-dealers

Six agro-dealer companies were surveyed in Nigeria. Their business resilience is relatively weak. While they have been in business for 4.4 years on average, they show a high dependency on individual farmers or traders as their customers and on selling seed, fertiliser and/or agro-chemicals as their main service (Table 109, Table 111 and Table 112 in Annex 4). They do not engage in import of inputs or in wholesale and they do not offer agricultural advisory services to farmers. Nevertheless, their financial performance is relatively strong, with an average annual turnover of close to US$590,000 and good access to formal credit (Table 114 in Annex 4). The agro-dealers surveyed only declared one investment in the last three years, mainly represented by equipment purchases (see Table 113 in Annex 4). They have very few staff (around 5 permanent and 3 casual labourers), and particularly very few female staff, but a high percentage of skilled workers.
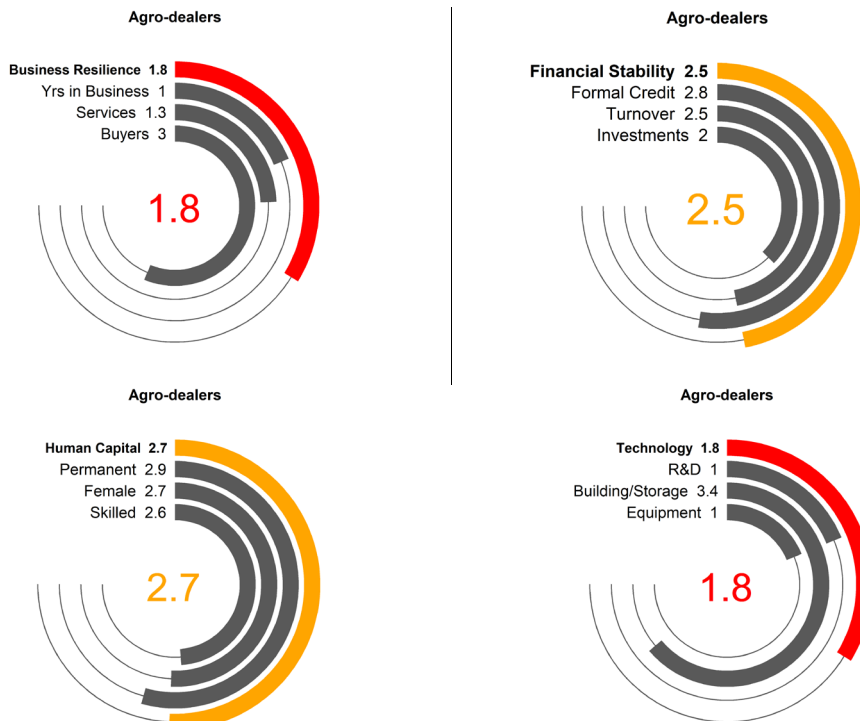
Figure 18: Agro-dealers' performance scorecard

Input supply companies

Eight input supply companies participated in the survey. It is notable that they score rather poorly on business resilience (they have the lowest score on this dimension of all SMEs surveyed). This is due to the fact that these SMEs have only been in business for around four years on average (see Table 109 in Annex 4) and reveal a high dependency on offering one key service: wholesale and countrywide distribution of inputs. Only a few companies engage in the manufacturing of inputs. Despite their fragile business resilience, input companies showcase strong financial stability. They have a high turnover of around US$3.04 million (Table 109 in Annex 4)[6] and have good access to formal credit (Table 114 in Annex 4). They made almost three investments, on average, in the last three years, mainly in equipment, staff training and in the injection of working capital (see Table 113 in Annex 4). They employ 27 permanent and 15 casual staff, on average, and are able to pay high salaries to their permanent employees. The number of female staff is low.

Figure 19: Input supply companies' performance scorecard

Agri-value chain actors

Ten SMEs were surveyed that operate in agricultural value chain sector (processors, traders, aggregators). These types of SMEs seem to have low business resilience, not only because of the limited number of years in business, but also because they offer only around one service, on average, mainly the aggregation of farmers' production or agri-food processing (Table 112 in Annex 4). However, they do manage to diversify their market risk by dealing with more than three types of buyers on average (Table 111 in Annex 4). Agri-value chain SMEs have an average annual turnover of just over US$210,000 – the lowest among the surveyed SME categories (Table 109 in Annex 4). They have good access to formal credit, which they have used to make three investments, on average, in the last three years,

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[6] Turnover of one input supply company is not included since it was considered as an outlier – most likely due to over-reporting by the SME.

especially in R&D, building/storage and equipment (Table 113 in Annex 4). They create employment for 42 permanent and even 300 casual workers. While they have the highest proportion of female workers among the surveyed SME categories, this is still low.

Value Chain

Business Resilience 2.3
Yrs in Business 1
Services 1.9
Buyers 3.9

2.3

Value Chain

Financial Stability 2.8
Formal Credit 3.2
Turnover 3.3
Investments 1.8

2.8

Value Chain

Human Capital 2.7
Permanent 3.3
Female 2.3
Skilled 2.4

2.7

Value Chain

Technology 2.8
R&D 2.5
Building/Storage 2.8
Equipment 3.1

2.8

Figure 20: Agri-value chain actors' performance scorecard
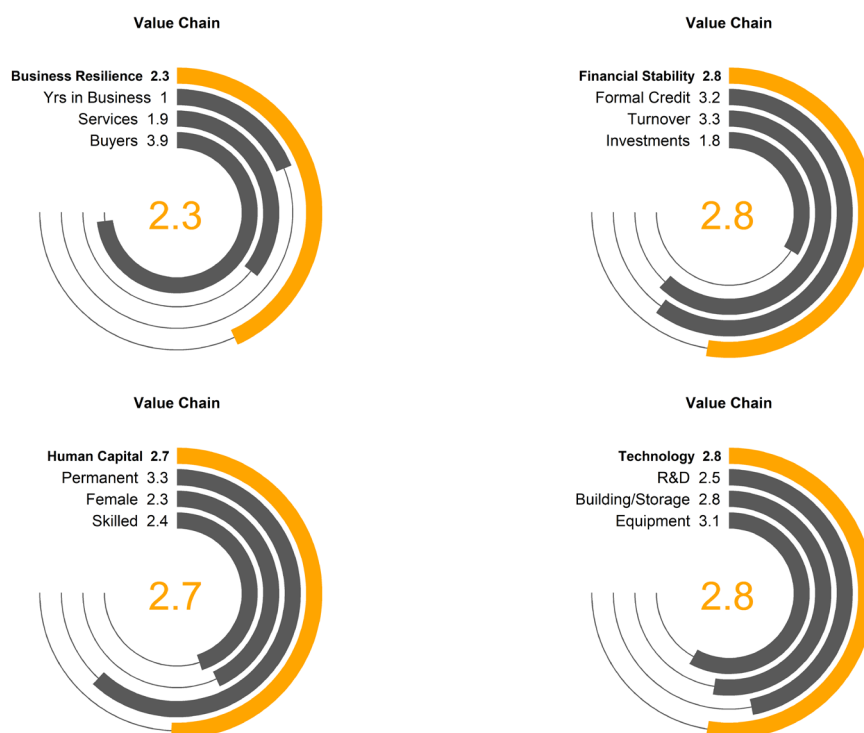
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Annex 1. List of interviews for qualitative systems monitoring

Organisation	Respondent	Department/function	Date	Relation to AGRA
International Food Policy Research Institute	Dr Bedru Balana	Senior Research Staff	19 June 2019	Independent expert
Federal Ministry of Agriculture and Rural Development (FMARD)	Ibrahim Mohammed (and five colleagues)	planning office	19 June 2019	Grantee
AGRA Nigeria	Dr. Kehinde Makinde	Country Manager	19 June 2019	AGRA
FMARD	Prof. Victor O. Chude	CEO National Programme for Food Security (NPFS)	19 June 2019	Independent expert
USAID	Dr Charles Iyangbe, Osagie Aimiunu, and Oladele Kolade		20 June 2019	Funder
Nigeria Economic Summit Group (NERG)	Dolapo Enejoh	Programme Manager	20 June 2019	Grantee
National Agricultural Seeds Council (NASC)	Prof Olusegun Ojo	Director General	20 June 2019	Grantee
Kaduna State Ministry of Agriculture and Forestry	Yakubu Gora		21 June 2019	Grantee
Institute of Agricultural Research (IAR)			21 June 2019	Grantee
Nigeria Agricultural Extension and Research Liaison Services (NAERLS),	Prof Christogonus Daudu		21 June 2019	Grantee
Premier Seeds	Prof Abraham Ogungbile	CEO	21 June 2019	Grantee
AGRA	Godswill Aguiyi	Programme officer	24 June 2019	AGRA
North Central Agro- Inputs Dealers Association	Patrick Esogban		24 June 2019	Grantee
Niger Ministry of Agriculture and Rural Development			24 June 2019	Grantee
Tecni Seeds	Halidu Mohammmed	Field Officer	25 June 2019	Grantee
Africa Rice	Dr. Philip Idinoba		26 June 2019	Independent expert

AGRA	Celicard Zonkeng		26 June 2019	AGRA
Seedam	Stephen Adigun	CEO	27 June 2019	Grantee
Sasakawa	Isaac Eni,	Kaduna branch manager	27 June 2019	Grantee

Annex 2. Data dictionary of main indicators

Indicator	Definition
G2: Average number of months of adequate household food provision	The average number of months of adequate household food provision.
G6: Wealth assets index score	The DHS household wealth index is a composite measure of a household's cumulative living standard. It is composed of data on asset ownership, materials used for housing construction, and types of water access and sanitation facilities. Wealth index values typically range between -2 and 2, with 0 being on the centre of the distribution.
G6.1 Share of households in first wealth quintile (%)	The share of households in the first wealth quintile (based on the country average).
G6.2 Share of households in second wealth quintile (%)	The share of households in the second wealth quintile (based on the country average).
G6.3 Share of households in third wealth quintile (%)	The share of households in the thirds wealth quintile (based on the country average).
G6.4 Share of households in fourth wealth quintile (%)	The share of households in the fourth wealth quintile (based on the country average).
G6.5 Share of households in fifth wealth quintile (%)	The share of households in the fifth wealth quintile (based on the country average).
IWI International Wealth Index	The International Wealth Index (IWI) is the first comparable asset based wealth index covering the complete developing world. It is based on data for over 2.1 million households in 97 low and middle income countries. Based on DHS household wealth index variables.
1. Average yield (kg/ha)	The average harvest quantity of the crop in the main season (kg) divided by the amount of land on which the crop is cultivated (ha) per farm household. In case respondents reported production and cultivated area in different units, conversions to kilogrammes and hectares were made respectively.
3. Rate of application of target improved productivity technologies or management practices (indicator 14)	The percentage of farm households using improved varieties or inorganic fertiliser.
3.1 Adoption of improved varieties (%)	The percentage of farm households using improved OPVs or hybrids. Farm households cultivating varieties that could not be classified were counted as not using improved varieties.
3.2 Adoption of endorsed varieties (%)	The percentage of farm households using varieties that are endorsed by AGRA and its partners.
3.3 Number of seasons variety is recycled	The average number of seasons the variety has been recycled.
3.4 Adoption of endorsed planting practice (%)	The percentage of farm households using the specific spacing of seed as promoted by AGRA and partners.
3.5 Adoption of inorganic fertiliser (%)	The percentage of farm households applying inorganic fertiliser.
3.6 Adoption of endorsed fertiliser (%)	The percentage of farm households applying fertiliser endorsed by AGRA and its partners.

Indicator	Definition
3.7 Adoption of organic fertiliser (%)	The percentage of households applying organic fertiliser.
3.8 Adoption of inoculants (%)	The percentage of households applying inoculants.
3.9 Adoption of pest-management practices (%)	The percentage of households applying pesticides, herbicides or fungicides, or a combination of the three.
3.10 Adoption of endorsed post-harvest practices (%)	The percentage of households making use of a tarpaulin while drying and/or threshing their harvest.
3.11 Adoption of improved storage (%)	The percentage of households making use of improved storage facilities, such as PICS bags or silos.
3.12 Use of designated storage facilities (%)	The percentage of households storing their produce using storage at the farmer's organisation, a warehouse receipt system, or private storage.
3.13 Adoption of tablets to preserve quality of recycled seed (%)	The percentage of households using tablets to preserve the quality of their seed stock.
Hectares under improved technologies or management practices (%)	The total land area under improved varieties or inorganic fertiliser as a share of the total land area on which the crop is cultivated.
3.14 Area under improved varieties (%)	The total number of has under improved varieties (hybrid or OPV) as a share of the total land area on which the crop is cultivated.
3.15 Area under inorganic fertiliser (%)	The total number of has on which inorganic fertiliser is applied for the cultivation of the crop as a share of the total land area on which the crop is cultivated.
3.16 Area under pesticides (%)	The total number of has on which pesticides, herbicides, or fungicides were applied for the cultivation of the crop as a share of the total land area on which the crop is cultivated.
4. Access to agricultural advisory extension support services (indicators 16)	The share of households that is visited by an agricultural extension agent during the last 12 months.
4.1 Average number of visits per year by agricultural advisory extension support services	The average number of visits by an agricultural extension agent during the last 12 months among farm households that have been visited at least once.
4.2. Received small seed pack (%) (additional indicator 4)	The percentage of households that received a promotional seed pack.
4.3 Used small seed pack (%) (additional indicator 4)	The percentage of households that used the seeds from the promotional seed pack received.
4.4 Distance to nearest agro-dealer (minutes) (additional indicator 1) (indicator 15)	The average distance to the nearest input supplier in minutes. Considers only households that could estimate this in minutes. Households that could only report this in distance are reported separately.
5. Nitrogen application (kg/ha)	The average amount of nitrogen (in kg) applied per ha of land on which the crop is cultivated.
5.1 Phosphorus application (kg/ha)	The average amount of phosphorus (in kg) applied per ha of land on which the crop is cultivated.
5.2 Potassium application (kg/ha)	The average amount of potassium (in kg) applied per ha of land on which the crop is cultivated.
Average fertiliser use (Total N + P + K, kg/ha) (Indicator 21)	The average sum of nitrogen, phosphorus and phosphorus (in kg) applied per ha of land on which the crop is cultivated.

Indicator	Definition
6. Percent of post-harvest losses (%) (indicator 22)	The share of harvest that is lost and thus not consumed, stored, given away, sold, bartered, or used as payment in kind.
10. Value of incremental sales as a result of AGRA (crop revenue) (US$)	The revenues from selling the crop, converted from local currency to US$ by using the 2018 average exchange rate.
13. Access to formal financial services (%)	The percentage of households that have access to formal financial services (either a bank account, a loan, or insurance)
13.1 Bank account (%)	The percentage of households that have a bank account.
13.2 Agricultural loan (%)	The percentage of households that took a loan from a formal financial institution in 2018. Formal financial institutions include banks, microfinance institutions, savings and credit cooperatives and mobile money.
13.3 Agricultural insurance (%)	The percentage of households that took crop insurance in 2018.
17. Average age of varieties used (years)	The average age of varieties used (in years).
33. Sale through structured trading facilities/arrangements (%) (indicators 30)	The sale through structured trading facilities or arrangements is defined as the number of households selling their harvest through formal contractual arrangements as a percentage of the total number of households selling at least some of their harvest.
33.1 Selling to traders/middlemen (%)	The percentage of farm households selling their harvest to traders/middlemen.
33.2 Selling to consumers (%)	The percentage of farm households selling their harvest to consumers.
33.3 Selling to friends/neighbours (%)	The percentage of farm households selling their harvest to friends/neighbours.
33.4 Selling to aggregation centre (%)	The percentage of farm households selling their harvest to aggregation centres.
33.5 Selling to farmer organisation (%)	The percentage of farm households selling their harvest to farm organisations
33.6 Selling to wholesalers (%)	The percentage of farm households selling their harvest to wholesalers.
33.7 Selling to processors (%)	The percentage of farm households selling their harvest to processors.
33.8 Selling to retailers (%)	The percentage of farm households selling their harvest to retailers.
33.9 Selling to company (undefined) (%)	The percentage of farm households selling their harvest to a company (in an undefined sector).
33.10 Selling to institutional buyers (%)	The percentage of farm households selling their harvest to institutional buyers.
37. Access to market information through formal channel (%)	The share of farm households receiving market information through formal channels (SMS, radio, television, farmer's organisation).

Numbering according to the terms of reference. In parenthesis numbering of AGRA's Theory of Change

Annex 3. SME performance scorecards

Table 105: Business resilience performance scorecard

Business resilience		Performance Category 1	Performance Category 2	Performance Category 3	Performance Category 4
Years in business	Ranges (Years)	1-5	5-10	10-15	>15
	Score	1	2	3	4
Number of services	Ranges (#)	1	2	3	>3
	Score	1	2	3	4
Number of buyers	Ranges (#)	1	2	3	>3
	Score	1	2	3	4

Table 106: Financial sustainability performance scorecard

Financial sustainability		Category 1	Category 2	Category 3	Category 4
Percentage using formal credit	Ranges (%)	0%	0%-33%	33%-66%	>66%
	Score	1	2	3	4
Annual turnover (US$)	Ranges (thousands)	1-10	10-25	25-50	>50
	Score	1	2	3	4
Number of investments	Ranges (#)	0	1	3	>3
	Score	1	2	3	4

Table 107: Human capital performance scorecard

Human capital		Category 1	Category 2	Category 3	Category 4
% Female	Ranges (%)	0%	0%-33%	33%-66%	>66%
	Score	1	2	3	4
% Skilled	Ranges (%)	0%	0%-33%	33%-66%	>66%
	Score	1	2	3	4
% Permanent	Ranges (%)	0%	0%-33%	33%-66%	>66%
	Score	1	2	3	4
% Casual	Ranges (%)	0%	0%-33%	33%-66%	>66%
	Score	1	2	3	4

Table 108: Technology performance scorecard

Technology		Category 1	Category 2	Category 3	Category 4
Investments in R&D	Ranges (#)	0	-	-	1
	Score	1			4
Building storage	Ranges (#)	0	-	-	1
	Score	1			4
Equipment	Ranges (#)	0	-	-	1
	Score	1			4

Annex 4. SME descriptive statistics

Table 109: General SME characteristics

General SME Characteristics	Seed Companies	Input Supply Agro-Dealers	Input Supply Companies	Agri Value Chain
Years of business	3.83	4.4	4.0	3.9
	(0.98)	(0.89)	(1.15)	(1.19)
Average number of commodities				
Commericalized/traded	7.14			2.6
	(2.3)			(2.75)
Processed				1
				(1.63)
Transported				1.9
Commodities commercialized/traded				(3.7)
Maize	57.14%			30%
Sorghum				10%
Rice	42.86%			60%
Permanent staff**	49	5.4	27.4	42.3
	(29.67)	(2.60)	(34.8)	(61.60)
Casual staff	70.28	3.2	15.16	300
	(40.18)	(1.30)	(8.75)	(825)
Total annual turnover (USD)*	931841	587422	3042381	2121677
	(1113729)	(1076369)	(4049860)	(3373300)
Observations	7	6	8	10

Standard Deviation in parenthesis
*Annual turnover information incomplete. Detailed information reported below.
Agri-Value Chain: Obs annual turnover 90%
Seed Companies: Obs annual turnover 71%
Input Supply agro dealers: Obs annual turnover 66%
Input Supply companies: Obs annual turnover 37%

Table 110: SME employees

Employees	Seed Companies	Input Supply Agro-Dealers	Input Supply Companies	Agri Value Chain
Permanent Staff	49	5.4	27.4	42.3
	(29.67)	(2.60)	(34.8)	(61.60)
Casual Staff	70.28	3.2	15.16	300
	(40.18)	(1.30)	(8.75)	(825)
% Female (over total)	19%	24%	14%	25%
% Skilled (over totoal)	24%	37%	28%	28%
Annual Salary Permanent (USD)*	66859	4431	68145	97753
	(80155)	(3466)	(76377)	(233428)
Annual Labor Cost Casual (USD)*	20629	197	4810	13043
	(19809)	(116)	(4859)	(21699)
Daily Wage Casual (USD)*	2.25	5.66	2.83	88.61
	(0.71)	(6.09)	(0.26)	(241.90)

Standard Deviation in parenthesis. *Incomplete information for Annual Salary and Daily wage. Detailed information reported below.
Agri-Value Chain: Obs salary permanent workers: 70%; Obs salary casual workers 50%; Obs daily wage 80%
Seed Companies: Obs salary permanent workers: 85%; Obs salary casual workers 71%; Obs daily wage 85%.
Input Supply agro dealers: Obs salary permanent workers: 83%; Obs salary casual workers 50%; Obs daily wage 83%.
Input Supply companies: Obs salary permanent workers: 57%; Obs salary casual workers 28%; Obs daily wage 71%.

Table 111: SME buyers

Buyers	Seed Companies	Input Supply Agro-Dealers	Input Supply Companies	Agri Value Chain
Projects, programs and government	100%			90%
Farmer organizations, coops, associations	100%	80%	100%	100%
Individual buyers / producers	100%	100%	28%	100%
Traders, input suppliers, wholesalers	100%	100%	100%	100%
Average number of buyers	4 (0)	2.6 (0.89)	2.28 (0.48)	3.9 (0.31)
Observations	**7**	**5**	**7**	**10**

Table 112: SME services

SME Services	Seed companies
Variety development	28%
Breeder seed production	42%
Production early generation / foundation seed	85%
Production improved / certified seed	100%
Production of noncertified seed	
Sales improved / certified seed	71%
Average number of services provided	3.28 (1.38)
Observations	**7**

SME Services	Input supply agro dealers	Input companies
Retail (sales) of improved / certified seed	20%	
Retail (sales) of chemical fertilizers and pesticides	10%	14%
Advisory services / extension		
Import of inputs		14%
Wholesale and country-wide distribution		71%
Manufacturing of inputs		28%
Average number of services provided	1.2 (0.44)	1.28 (0.48)
Observations	**6**	**8**

SME Services	Agri Value Chain
Aggregation of farmer production (transport, bulking and storage)	80%
Agri-food processing (transformation of produce)	60%
Transport	30%
Mechanization	20%
Average number of services provided	1.9 (0.99)
Observations	**10**

Table 113: SME investments

Investments	Seed Companies	Input Supply Agro-Dealers	Input Supply Companies	Agri Value Chain
Expansion of land area	42%			50%
Expansion of buildings and/or storage	71%	20%	28%	60%
Upgrading of equipment	71%	80%	57%	70%
Research & Development	57%		28%	20%
Training of staff	57%	20%	42%	70%
Increase / injection for working capital	28%	20%	100%	30%
No Investment	44%			10%
Average number of investments	3.28 (1.49)	1.4 (0.54)	2.71 (1.60)	3 (1.63)
Observations	**7**	**5**	**7**	**10**

Table 114: Percentage of credit from formal sources

% Credit from formal sources	Seed Companies	Input Supply Agro-Dealers	Input Supply Companies	Agri Value Chain
0%		20%	14.29%	5.26%
<10%				
10-25%				33.33%
25-50%	28.57%		14.29%	33.33%
50-75%	14.29%		28.57%	
75%-90%	28.57%	60%	28.57%	11.11%
>90%	28.57%	20%	14.29%	22.22%
Observations	**7**	**5**	**7**	**10**

Table 115: AGRA support services

AGRA Services	Seed Companies	Input Supply Agro-Dealers	Input Supply Companies	Agri Value Chain
Grant	57%	20%		10%
Loan/Credit		40%		
Training	28%	60%		
Technical Assistance	42%	40%		
Other	14%	20%	29%	
No Service	28%	40%	71%	90%
Average Number AGRA Services	1.42 (1.27)	1.8 (1.78)	0.28 (0.48)	0.1 (0.31)
Observations	**7**	**6**	**8**	**10**

Standard Deviation in parenthesis

Annex 5. SMEs participating in the interviews

Table 116: Sampled SMEs for performance survey

Commercial seed producers	Seed companies	Input supply/Agro dealers	Input companies	Agri value chain
Agro Main	Da All Green Seeds Ltd	Adalinci Agro Nigeria Ltd	AR-RAHIM Synergy Nigeria Ltd	AFEX Commodities Exchange Ltd
Albarka Farm	Manoma Seeds Ltd	Bologi Global Resources	Duraaya International Ltd	Farm Fresh Foods Ltd
Jibrin Farm	Maslaha Seeds Ltd	Dynamite Ventures Nigeria Enterprise	Goldagric Nigeria Ltd	Afritech Multi Concepts Ltd
Jolynga Farms	Premier Seed Nigeria Ltd	New Era Agrochemicals	Harvestfield Industry Ltd	Da-All Green Seeds Ltd
Shuaibu Farms	Tecni Seeds Ltd	Ruftee Investment Nigeria Ltd	Kano Agricultural Supply Company	Labar Grains and Feeds Ltd
	The Seed Project Company Ltd	Rufcee Agro Chemical	Morris Nigeria Ltd	Enoch Stone Nigeria
	Value Seeds		Saro Agrochemicals	Ruftee Investment Nigeria Ltd
			Tecni Seeds Ltd	Feeds Ltd
				Nko Bologi
				Yabcom