Reorienting public agriculture R&D for achieving sustainable, nutritious and climate resilient food systems in Nigeria

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This is a joint publication by the Syngenta Foundation for Sustainable Agriculture and Sahel Consulting Agriculture & Nutrition Ltd., as part of the global study focusing on reprioritizing agricultural R&D agenda to address future needs.

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ACRONYMS

AATF	African Agricultural Technology Foundation
ADPs	Agricultural Development Programmes
AfDB	African Development Bank
AGRA	Alliance for a Green Revolution in Africa
APP	Agricultural Promotion Policy
ARCN	Agricultural Research Council of Nigeria
ASTI	Agricultural Science and Technology Indicators
ATA	Agricultural Transformation Agenda
BASICS	Building an Economically Sustainable Integrated Cassava Seed System
BMGF	Bill and Melinda Gates Foundation
DFID	Department for International Development
FCAs	Federal Colleges of Agriculture
FGN	Federal Government of Nigeria
FMARD	Federal Ministry of Agriculture and Rural Development
FME	Federal Ministry of Education
FMEO	Federal Ministry of Environment
FMST	Federal Ministry of Science and Technology
FAO	Food and Agriculture Organization
GIZ	German Agency for International Cooperation
IAR	Institute for Agricultural Research
IAR&T	Institute of Agricultural Research and Training
ICRISAT	International Crops Research Institute for Semi-Arid Tropics
IITA	International Institute of Tropical Agriculture
IPR	Intellectual Property Rights
NAERLS	National Agricultural Extension Research Liaison Services
NAPRI	National Animal Production Research Institute
NARIs	National Agricultural Research Institutes
NARS	National Agricultural Research System
NCRI	National Cereals Research Institute
NIFFR	National Institute for Freshwater Fisheries Research
NIHORT	National Horticultural Research Institute
NRCRI	National Root Crops Research Institute
NSPRI	Nigeria Stored Products Research Institute
SFSA	Syngenta Foundation for Sustainable Agriculture
USAID	United States Agency for International Development
YIIFSWA	Yam Improvement for Income and Food Security

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EXECUTIVE SUMMARY

The agricultural research ecosystem in Nigeria is complex and characterized by several actors and stakeholders who shape the policy and funding environment and support the implementation of programmes. However, the activities of the National Agricultural Research Institutes (NARIs) and international research institutes are central to the agriculture and food research landscape in Nigeria.

The NARIs have formal mandates to conduct research on food and tree crops, livestock and fisheries, extension services, mechanization, and post-harvest management. The NARIs achieve these research mandates through collaboration with several stakeholders such as educational institutions, state-based Agricultural Development Programmes (ADPs), NGOs, private companies, farmer organizations, and development organizations. Six of the 15 CGIAR Centres are active in Nigeria and collaborate with the NARIs and other stakeholders to conduct research and implement donor-funded agriculture and food programs.

The Federal Government of Nigeria (FGN), development organizations, and donor partners are the primary funders of public agricultural research in Nigeria. The FGN provides funds to the NARIs in its yearly budget appropriation, and development organizations and donor partners offer direct funding to implement agricultural development initiatives with research components. Sahel's analyses reveal that annual government funding disbursement to the NARIs for public agricultural research is usually lower than the amounts appropriated in the approved national budget. Also, personnel costs account for over 70% of the funding disbursed to the NARIs, and the complexity of budget appropriation delays government funding disbursement.

The current structure of the Agricultural Research Council of Nigeria (ARCN) limits the agricultural research system's effectiveness. Despite its mandate to coordinate public agricultural research for the nation, ARCN only supervises the fifteen NARIs under the Federal Ministry of Agriculture and Rural Development (FMARD). The other institutes and agencies that conduct agricultural research report to other ministries and agencies. This flawed structure leads to poor coordination of research efforts as the research-focused institutions that are not under the control of the ARCN are not accountable to the agency. Furthermore, the national research system lacks monitoring, evaluation, and learning frameworks that could ensure accountability and responsible knowledge transfer to end-users. Consequently, most of the research programmes are not demand-driven, and there are no clear metrics for measuring their impact and effectiveness. An assessment of the funding data between 2014 and 2019 from NARIs and international research institutes revealed that research has focused largely on crop productivity improvements. Also, expert interviews revealed that crop research had focused mainly on the impact areas of productivity than other research on sustainability, nutrition, and climate resilience. Sadly, historical data on crop yields in the last ten years shows a decline in output for some crops and insignificant yield increase for other crops, which implies that the impact of research on productivity improvement is low.

To advance public agriculture and food research in Nigeria, stakeholders must address the research ecosystem's challenges and reorient the agricultural research and development plan. Specific areas to prioritize in the advancement of agricultural research in Nigeria include climate resilience and nutrition research and ensure the use of technology and data to inform research planning. This transformation will require some critical steps:

- The development of a national agricultural research strategy hinged on the agricultural goals set under the current Medium-term National Development Plans (MTNDP) for 2021 to 2025.
- Comprehensive capacity building initiatives which engage the private sector to streamline and strengthen the capacity of ARCN and NARIs to deliver on their mandates. This initiative must include the institutionalization of clear measurement and evaluation mechanisms that will foster a performance-driven culture.
- Diversify and increase funding sources for research activities, instituting systems and structures to enhance the efficiency and effectiveness of the allocation and utilization process.
- Transform the national and state-level extension service delivery system to bridge the linkage gap between researchers and end-users and ensure demand-driven research and the efficient commercialization of innovative solutions.
- Ensure the protection of intellectual property rights (IPR) of researchers and clear adherence to protocols for the use of research generated from the NARIs.
- Foster collaboration among the NARIs to ensure synergy, eliminate overlap of research activities and promote efficient communications and knowledge sharing.

The transformation of Nigeria's agriculture research ecosystem will require significant political will from the national government, including the presidency, as well as cooperation and support from the private sector and the development and funding community. Ultimately, the ability to create a demand-driven research agenda at the ARCN and create a performance-driven culture among the NARIs will eventually foster growth and development in the Nigerian agriculture landscape and food ecosystem.

INTRODUCTION

To achieve food and nutrition security for a growing population, sustainable agriculture, and the SDGs, global agri-food systems must be transformed. That transformation will require innovation, driven by the needs of farmers, consumers, and the environment. Research has an important role to play in supporting the innovation process. Investments in agri-food system research in developing countries will have to be scaled up, from both public and private sectors. New approaches to innovation cooperation between governments, businesses and agricultural organizations are needed, particularly to target poverty, nutrition and sustainability issues in the agri-food system.

Given the needs to develop and deliver innovative products and services to tackle gaps that poor farmers and consumers face in moving towards a more integrated agri-food system, how should public agriculture and food R&D in Nigeria be reoriented and supported? This study aims to shed light on the past and current focus of public agriculture R&D agenda, major shifts and trends in both public and private research spending at the country level, and to provide recommendations on how to reorient the future R&D agenda that addresses major gaps and integrate nutrition, sustainability and climate resilience needs, and lay down necessary steps and actions for making the shift, and corresponding investment and policy changes.

The Syngenta Foundation commissioned this study, which was completed by the Sahel Consulting Agriculture & Nutrition (Sahel) between April 2020 and March 2021.

Scope of work

The study aimed to unpack the agriculture and food research agenda in Nigeria, focusing on the past and current public agriculture and food research and development initiatives and significant shifts and trends in public and private research spending in Nigeria.

This study aimed to answer three key research questions:

- What are the current significant initiatives, spending levels, and drivers of national public and private research and development funding on agriculture and food? What are the main policy areas and objectives having implications for research and development in the country?
- What are the gaps being faced by poor farmers and consumers not supported by the current system? What are the outcomes of past research and development portfolio in terms of agricultural development, poverty reduction, food and nutrition security, and environmental sustainability?
- What should be the priorities to tackle these gaps, and what needs to shift to manage the public research and development system to deliver on those priorities? What are the priority areas in public research and development to tackle these major gaps?

Research Methodology

Data Collection

The Sahel team derived the data collected for this study from both primary and secondary sources. First, the team reviewed all in-house and external documents, datasets, and reports related to public agriculture and food research and development activities in Nigeria. The Sahel team obtained information on the activities and current initiatives of critical stakeholders in public agricultural research through desk research. The team also identified the principal funders of food and agricultural research and their priority areas, trends in thematic areas of agricultural research and development, and the impact areas of productivity, nutrition, sustainability, and climate resilience.

The Sahel team then engaged selected stakeholders through remote and in-person interviews and the administration of questionnaires to gather primary data on current trends, gaps, and challenges in food and public agriculture research in Nigeria. The team developed tailored discussion guides and questionnaires for all stakeholder interviews to ensure comprehensive, consistent, and relevant information. The team designed questionnaires to gather qualitative and quantitative data as appropriate and address this study's key research questions. The SFSA team provided input to the questionnaires and approved them before the Sahel team commenced field interviews.

Using the discussion guides, Sahel conducted 52 interviews with stakeholders through phone calls and virtual meetings. Stakeholders engaged during interviews include government ministries and agencies, national agricultural research institutes and CGIAR centres, private sector companies, farmer associations, donor organizations and non-governmental organizations (NGOs). Appendix I shows the roles and seniority level of respondents across the stakeholder groups.

The Sahel team sent questionnaires to nine (9) out of the fifteen National Agricultural Research Institutes (NARIs) working on crucial food and industrial crops, livestock, and extension research in Nigeria to gather data on their agricultural research funding and spending trends over ten years. The team included the nine (9) NARIs in the data collection due to their research focus on crops and commodities important for food security in Nigeria and the focus on extension services research. The crops and commodities analyzed in this study include cassava, yam, maize, rice, soybean, fruits and vegetables, and fisheries. The selected NARIs include Institute for Agricultural Research & Training (IAR&T); National Horticultural Research Institute (NIHORT); National Cereals Research Institute (NCRI); Nigerian Stored Products Research Institute (NSPRI); Institute for Agricultural Research (IAR); National Agricultural Extension and Research Liaison Services (NAERLS); National Institute for Freshwater Fisheries Research (NIFFR), National Root Crops Research Institute (NRCRI), and the National Animal Production Research Institute (NAPRI). The team also engaged two CGIAR centres, the International Institute of Tropical Agriculture (IITA) and AfricaRice Centre, to obtain additional data on Nigeria's agricultural research funding, including data on the crops analysed in this study.

Two main limitations affected the data collection process. At the beginning of the study, the team intended to visit at least four states in Nigeria – Oyo, Kaduna, Abia, and Abuja – due to agricultural research institutes' concentration in these states and regional representation. However, disruptions from the COVID-19 pandemic and rapid increases in the number of COVID-19 related

cases in Nigeria posed a limitation to domestic travel and physical meetings, hindering field visits to most states.

The second limitation to the data collection process was the reluctance of some of the NARIs to provide data on the actual research funding and spending trends, which they regarded as sensitive and confidential. The difficulty in obtaining research funding data from research institutes resulted in an extended project implementation timeline. The team engaged the Agricultural Research Council of Nigeria (ARCN) to retrieve the data from the NARIs to address this limitation. The team also reduced the numbers of years for the data requested on the actual research funding and spending trends from the NARIs, from the initial 10-year period (2009 – 2018) to 6 years (2014 – 2019), to encourage cooperation from the NARIs in providing the requested information.

While the ARCN could retrieve information on funding and spending trends from most of the nine (9) focus research institutes, it faced challenges obtaining data from two (2) key research institutes - NRCRI and NAPRI. The NRCRI was reluctant to disclose information on funding received from donors and private organizations, limiting the research findings of this study in addressing total funding and spending trends for public agriculture research on important root and tuber crops. The NAPRI did not provide any information on the total funding received for agriculture research, further limiting the study's research findings in addressing funding and spending trends for livestock research in Nigeria. As a result, data analysis only includes information from eight (8) of the nine (9) NARIs selected for the study. Appendix II presents the information received from the research institutes.

Data Analysis

The Sahel team synthesized the data obtained from primary and secondary sources to develop the report and extract coherent results to outline recommendations for reorienting agricultural research in Nigeria.

The team grouped the qualitative data from interview respondents across sectors in themes for analysis. For example, it assessed quantitative data on research funding for research institutes focusing on commodity crop and aquaculture research areas. This analysis highlighted the trends in agricultural research funding in Nigeria to reveal how funding has been allocated and spent across the impact areas of productivity, nutrition, sustainability, and climate resilience and identify major gaps.

In analyzing the quantitative data for this study, the Sahel team made certain assumptions, grouped into two: general assumptions on funding data and specific assumptions on funding data across this study's focus impact areas. Below are the assumptions:

General Assumptions on Funding Data

- The government's agricultural research funding includes the amounts disbursed to each of the NARIs for research programs, personnel payments, capital expenditure, and overhead costs.
- The agricultural research funding from donors and private sector organizations to research institutes comprise awarded research program expenses. It includes personnel payments

such as wages for ad hoc research support officers and allowances and stipends to researchers engaged in the project, not monthly salary payments.

- Amounts used in the analysis are in US dollars (USD). Amounts provided in Naira by the research institutes have been converted to USD using the average exchange rate for the year, as provided by the Central Bank of Nigeria (CBN).
- Amounts used in the analysis are not inflation-adjusted.

Specific Assumptions on Funding Data Across Focus Impact Areas of Productivity, Nutrition, Climate Resilience, and Sustainability

- In cases where more than one research institute, including IITA, has the mandate for the same crop or commodity, Sahel aggregated the spending across these institutes to identify the total spending on the focus impact areas for that crop.
- In cases where a particular research project covered multiple crops, impact areas, or years as stated by the research institutes, Sahel assumed that the research institute spent the reported total funding equally across the crops, impact areas or years.
- Analysis of spending trends covered the focus impact areas of interest for this study – productivity, nutrition, climate resilience, and sustainability. Additional amounts spent by the NARIs outside of the impact areas of interest were classified as "others". This "others" category includes other impact areas and activities such as youth empowerment, training, poverty alleviation, dissemination and transfer of research findings, and monitoring and evaluation as indicated by the research institutes.
- The amounts received from the Federal Government for specific research projects are not inclusive of personnel costs; however, Sahel assumed that funding received from donors for research projects might include allowances and stipends for researchers that worked on the projects.
- Information on research projects on specific crops provided by IITA was not inclusive of the impact areas of focus, as defined by the institute. Sahel made assumptions on the impact areas under which to classify the research projects based on desk research and the brief description of the projects as provided by IITA.

Following the analysis of the data obtained from all sources, the Sahel team:

- Provided insights into the three (3) key research questions of the study and analyzed the trends of research in productivity, nutrition, sustainability, climate resilience, and its impact on farmers and consumers.
- Provided recommendations on reorienting the future agriculture and food research and development agendas that address critical gaps in the research landscape and integrate nutrition, sustainability, and climate resilience needs.
- Outlined stakeholders' roles in developing the agriculture and food research ecosystem.

THE NATIONAL AGRICULTURAL RESEARCH SYSTEM AND POLICY ENVIRONMENT IN NIGERIA

This chapter will provide an overview of the National Agricultural Research System (NARS) in Nigeria. It will introduce the major actors and stakeholders in the sector and their activities and provide an overview of the past and current policy environment for agricultural research.

The National Agricultural Research System in Nigeria

According to Idachaba (1997) and as highlighted by Ragasa et al. (2010), Nigeria has arguably one of the most complex and diverse NARS in sub-Saharan Africa, with an extensive network of actors. These actors cut across the public and private sectors and the international community. They include the Federal Government of Nigeria (FGN) through its Ministries such as the Federal Ministry of Agriculture and Rural Development (FMARD), Federal Ministry of Science and Technology (FMST), Federal Ministry of Environment (FMOE), and the Federal Ministry of Education (FME), their departments and agencies, the National Agricultural Research Institutes (NARIs), educational institutions, State Agricultural Development Programmes (ADPs), private organizations and international actors such as the CGIAR centres, donor organizations and development partners.

These actors' roles within the NARS range from governance to the coordination of research activities, conduct of research, provision of technical support and funding for research activities, provision of extension services, and transfer of research findings to end-users.

Below is a figure showing the key actors within the NARS in Nigeria and how they interact in the landscape. This chapter will further highlight the roles of these actors.

Overview of Key Actors and their Interactions within the National Agricultural Research System
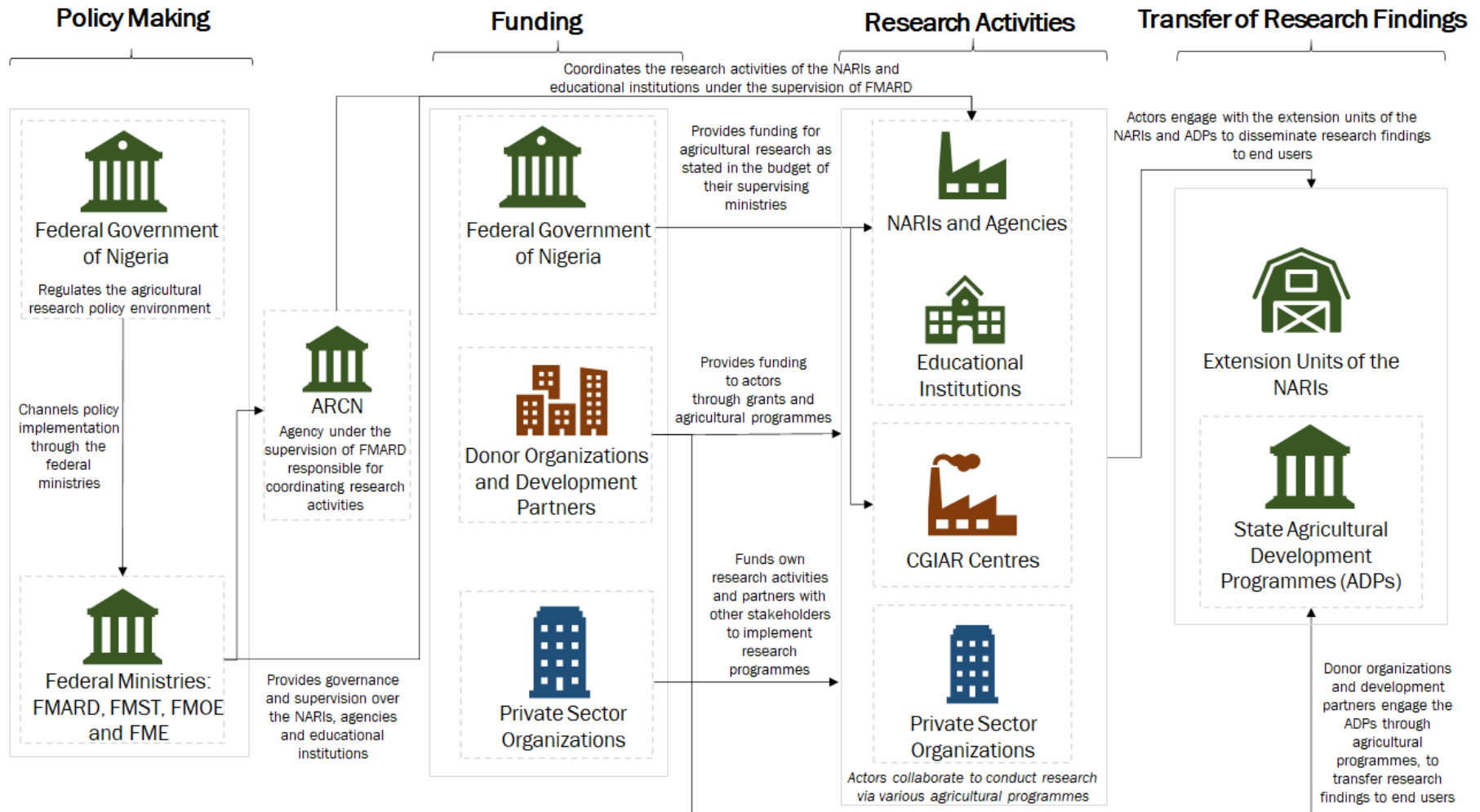
Figure 1 - Overview of Key Actors and their Interactions within the National Agricultural Research System

Key Actors in the National Agricultural Research System

Public Sector Actors

A. **The Federal Government of Nigeria (FGN):** The FGN provides funding for agricultural research and regulates the agricultural research policy environment. Through the related ministries, the FGN also provides governance and oversight over departments, agencies, and institutions such as the NARIs and educational institutions responsible for the coordination and conduct of agricultural research activities. Below are the related ministries and their activities in the landscape:

- **Federal Ministry of Agriculture and Rural Development (FMARD):** Established in 1966, the FMARD is the national ministry with the responsibility to ensure food security in crops, livestock, and fisheries, stimulate agricultural employment and services, promote the production and supply of raw materials to agro-industries, provide markets for the products of the industrial sector, generate foreign exchange, and aid rural socio-economic development. The FMARD is primarily involved in public agricultural research and development through its agencies.

  The ministry provides oversight for eleven agencies, including the Agricultural Research Council of Nigeria (ARCN), the agency responsible for coordinating, supervising, and regulating agricultural research activities, training, and extension. The Agricultural Research Council of Nigeria Act of 1999 established the ARCN to prepare periodic master plans for agricultural research, inform the government on the financial requirement for implementation, and supervise and coordinate the research, training, and extension activities of research institutes.

  FMARD also supervises fifteen NARIs, the three (3) specialized Universities of Agriculture in the country, and sixteen Federal Colleges of Agriculture (FCA). Appendices III, IV, and V present the agencies, NARIs, and educational institutions under the supervision of FMARD.

- **Federal Ministry of Science and Technology (FMST):** The FMST was established in 1980 and is responsible for facilitating the development and deployment of science, technology, and innovation to enhance Nigeria's socio-development. The FMST coordinates science and technology research and development across all sectors in Nigeria, including agriculture. Six (6) of the agencies and institutes under the ministry's supervision are involved in agricultural research and development. Appendix VI presents the agencies and institutes under the control of the FMST.

- **Federal Ministry of Environment (FMOE):** The FMOE was established in 1999 to ensure the effective coordination of environmental matters in Nigeria. The ministry is responsible for protecting the environment against pollution and degradation and the conservation of the national natural resources for sustainable development in Nigeria. It supervises one (1) research institute, which is involved in agricultural research and development. Appendix VI presents the institute under the supervision of the FMOE.

- **Federal Ministry of Education (FME):** The FME was established in 1988 to direct educational activities in Nigeria. The FME ensures the compliance of educational institutions in Nigeria to the country's standard of education, including the institutions that deliver agricultural education and contribute to agricultural research and development efforts.

Fifteen NARIs are primarily responsible for agricultural research in Nigeria and are under the supervision of FMARD. As an agency under FMARD, the ARCN directly supervises and coordinates the activities of the fifteen NARIs. Eight (8) other institutes and agencies in Nigeria also contribute to public agricultural research, supervised by FMARD and other federal ministries. However, the recent Agricultural Research Council Act (Amendment) Bill 2019 which was passed into law in 2021 has reassigned two (2) of the eight (8) other institutes and agencies under the supervision of the ARCN.[1]

The NARIs and agencies have national mandates, as detailed in [Appendix VI,](#) which determines their research focus areas. Other relevant institutions in the landscape include the universities of agriculture and a range of agricultural colleges and institutions that focus on agricultural research.

B. **State Agricultural Development Programmes (ADPs):** The State ADPs also play an active role in contributing to Nigeria's agricultural research efforts. The ADPs commenced in 1975 under a tripartite agreement between the World Bank and the FGN as a platform for delivering extension services to farmers through extension agents. According to Daneji, M.I., (2011), the ADPs' activities cover three thematic areas, including the provision of infrastructural facilities in rural areas, training delivery on improved agricultural technologies, and the supply of farm inputs. In 1995, the ADPs were reconstituted as state parastatals to deliver extension services and transfer research technologies to farmers in collaboration with local government authorities, community leaders, organizations, and other stakeholders within the states. Despite their status as institutions of the states, the ADPs also support the implementation of the federal government and donor-funded agricultural projects and interventions in their respective states. Also, the ADPs sometimes engage with research institutes to disseminate research technologies to farmers.

International Actors

The actors in this category comprise the international research institutes, donor organizations, and development partners.

A. **International Research Institutes:** These include the CGIAR centres and the Association of International Research and Development Centres for Agriculture (AIRCA). These institutes partner with the NARIs and other key stakeholders such as the educational institutions, donor and development organizations, and the private sector, to promote agricultural research and development in Nigeria. While several CGIAR centres contribute to agricultural research and development via research programs in Nigeria, only six (6) CGIAR centres have offices in the

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[1] The recently passed Agricultural Research Council Act (Amendment) Bill 2019, now places institutions such as the National Centre for Agricultural Mechanization (NCAM) and the National Centre for Genetic Resources and Biotechnology (NACGRAB) under the supervision and control of ARCN. NCAM is an agency under the supervision of FMARD while NACGRAB is an agency formerly under the Federal Ministry of Science and Technology.

country. These include the International Institute of Tropical Agriculture (IITA), International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), International Food Policy Research Institute (IFPRI), the International Potato Centre (CIP), International Livestock Research Institute (ILRI), and Africa Rice Centre.[2] The table in [Appendix VII] details the research priority areas of these six (6) CGIAR centres. The CGIAR also supports the national agricultural research priorities in Nigeria as evidenced by the development of the Nigeria Site Integration Plan.[3] The only two (2) AIRCA centres with an active presence in Nigeria are the World Vegetable Centre and the International Fertilizer Development Centre.

B. **Donor and Development Organizations**: These actors provide funding support and technical assistance to government ministries, departments and agencies, the NARIs, educational institutions, and private sector organizations through various agricultural interventions. Some donors are also primary funders of research programmes implemented in Nigeria by the international research institutes in partnerships with other stakeholders within the NARS. Given the number of international development organizations supporting agricultural development and their various programmes in Nigeria, a donor working group comprising the major agricultural donors was set up to coordinate the activities of international donors in the sector and align donor investments to the FGN's agricultural development strategy.

Some donor organizations and development partners that provide support in the sector include the Bill and Melinda Gates Foundation (BMGF), the United Kingdom Department for International Development (DFID), the United States Agency for International Development (USAID), the Canadian Government, the German Agency for International Cooperation (GIZ), the African Development Bank (AfDB), World Bank, the Alliance for a Green Revolution in Agriculture (AGRA), and the African Agricultural Technology Foundation (AATF). According to the Nigeria Development Assistance Database (DAD), the BMGF is the biggest donor to Nigeria's agriculture sector, with an estimated funding commitment of over 400 million USD since 2007. According to the DAD, the other major donors are USAID, DFID, the Canadian Government, and GIZ. Some of the projects funded by these organizations solely focus on agricultural research or include research components implemented by actors within the NARS.

Private Sector Organizations

These include indigenous and international companies involved in the production and processing of food and beverages and the manufacturing and distribution of agricultural inputs. Some organizations partner with research institutes and development partners in Nigeria to implement research programmes and sometimes provide funding to research institutes to conduct agricultural research on specific value chains of interest. They are also end-users of public agricultural research solutions which they utilize for product development.

Historically, contribution and support from private sector companies to public agricultural research in Nigeria has been low. According to Beintema and Ayoola (2004) and as further highlighted by Flaherty, K., Ayoola, G., Ogbodo, J., & Beintema, N. (2010), private sector involvement in agricultural research and development in Nigeria has been minimal. Sahel's interviews

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[2] The IITA is the only CGIAR centre with its headquarters in Nigeria, with the other centres operating from country offices.
[3] In 2016, the CGIAR developed the Nigeria Site Integration plan, a country collaboration plan for Nigeria, to align the research programmes implemented by its research centres operating in Nigeria with the national agricultural research priorities.

corroborated the existing literature as respondents across stakeholder groups reported the low participation of private sector organizations in public agricultural research. However, some private sector organizations collaborate with research institutes on specific areas of interest or needs. Private sector stakeholders, specifically in the seed system, cited the absence of a strong Intellectual Property Rights (IPR) law in Nigeria as a major hindrance to their involvement and participation in public agricultural research.

The Agricultural Research Policy Environment in Nigeria

Since Nigeria's independence in 1960, the FGN has introduced various national agricultural policies and programmes to support the advancement of the agriculture sector. However, these policies and programmes have been broadly focused on developing the agricultural sector and not exclusively on the promotion of public agricultural research and development.

From 1962, the FGN introduced various National Development Plans, which included support for public agricultural research in Nigeria. The first National Development Plan of 1962 – 1968 included priority agricultural research areas of food and tree crops, fertilizer, pesticides, improved farm practices, and soil fertility, selected according to the country's needs at the time. Subsequent development plans also made provisions for agricultural research in additional areas such as fisheries, livestock, and forestry. In 2002, the FGN launched the National Special Programme on Food Security (NSPFS) to improve food security and reduce rural poverty. One of the programme's objectives, which ended in 2006, was to strengthen the effectiveness of research and extension services in transferring technology and new farming practices developed by research institutes to farmers and ensure the relevance of research to farmers.

From 2011 to date, the FGN has introduced two national policies, the Agricultural Transformation Agenda (ATA) - 2011 – 2015 and the Agricultural Promotion Policy (APP) - 2016 - 2020, broadly focused on the development of the agricultural sector, including the improvement of agricultural research and extension linkages through value chain specific programmes. The ATA also focused on transforming some key national priority value chains of the government, although not solely for research purposes. The APP is the most recent policy, focused on resolving key constraints that hinder the advancement of the sector. As identified by the policy, these constraints cut across sixteen areas, including research and innovation and climate-smart agriculture. The table in Appendix VIII details these sixteen intervention areas, with an implementation roadmap for achieving these objectives, as stated in the APP. While the Ministry is currently developing a new policy for the sector following the expiration of the APP in 2020, the FGN has already developed a Medium-term National Development Plans to span 2021 – 2025 to serve as a roadmap in the development of various sectors in the country, including one specifically focused on agriculture, food security and rural development. This plan has a strong climate and research focus.

It is important to mention two activities in the policy landscape that could impact agricultural research and development in Nigeria. The first activity dates to 2011, when the FGN inaugurated a Presidential Committee to advise on the restructuring and rationalization of the agencies, parastatals, and commissions of the government, including those that conduct agricultural-related research. In its report, commonly referred to as the Steve Oronsaye 2014 report, the committee provided recommendations to the FGN to reposition Federal ministries to supervise and restructure their parastatals and agencies in an efficient manner. The recommendations also included restructuring the ARCN and the merger of some agencies and parastatals under the

various government ministries involved in agricultural research. Although the FGN is yet to implement these recommendations, their implementation could eventually lead to significant restructuring and rationalization of some parastatals, agencies, and research institutions in the country.

Additionally, there has been recent efforts within the policy landscape to restructure the ARCN and improve its coordination of research activities in the country, evidenced by two bills, the ARCN (Repeal and Enactment) Bill 2019 (HB. 69) and the Agricultural Research Council Act (Amendment) Bill 2019. Both bills are similar and address the current limitations of the ARCN to coordinate agricultural research. The ARCN (Repeal and Enactment) Bill 2019 (HB. 69) passed the first and second readings at the House of Representatives on 11 July 2019 and 20 February 2020, respectively and has been referred to the *Committee of the Whole* for review, with the House awaiting the Committee Report. The Agricultural Research Council Act (Amendment) Bill 2019 passed the first, second and third readings on 29th October 2019, 19th March 2020 and 5th May 2021, respectively. In October 2021, the Agricultural Research Council Act (Amendment) Bill 2019 was assented by the President of the Federal Republic of Nigeria and passed into law. Appendix IX includes the critical components of the bills.

The passing of the Agricultural Research Council Act (Amendment) 2019 into law can strengthen the capacity of the ARCN to deliver on its mandate of coordinating agricultural research in the country. As highlighted by Babu et al. (2017), the ARCN operates the research coordinating council model and cannot effectively coordinate and influence research in the country due to its ineffective governance and the lack of coordination among the NARIs and actors in the NARS, amongst other factors. This new law will be instrumental in ensuring effective governance of NARIs and coordination of research activities within the NARS.

Chapter Summary

- The Nigerian NARS is diverse and consists of various actors and institutions categorized into three broad groups - public sectors actors, international actors, and private sector organizations. The most active actors in the NARS are stakeholders in the public sector and international actors, while the involvement of private sector organizations is minimal.
- Actors in the research system govern and coordinate research activities, conduct and disseminate research to end-users, and provide funding for research activities and projects.
- No policy in Nigeria focuses solely on agricultural research and development. To date, agricultural research has been included as a component of the agriculture sector's overall policy.

THE NATIONAL AGRICULTURAL RESEARCH INSTITUTES

This chapter will focus on the roles of the NARIs under FMARD as primary actors within the NARS in Nigeria. It will also highlight the activities of the NARIs and their collaboration and engagement with actors in the NARS. This chapter and subsequent sections of this report will focus only on the NARIs under the aegis of FMARD and supervised by the ARCN.

Research Focus of the National Agricultural Research Institutes (NARIs)

Each NARI's research focus is determined by its national mandate, as defined in the Establishment and the Amendment Act of the institute. As categorized in the Steve Oronsaye Report (2014), the NARIs conduct agricultural research across four (4) key areas, Crop; Fisheries and Oceanography Research; and Livestock and Veterinary Services and Agricultural Management, Capacity Building and Extension Services.[4]

A detailed description of each category and grouping of the NARIs is included below, based on Sahel's analysis:

- **Crop Research:** Research focuses on the genetic improvement and production of the primary food, vegetable, and cash crops grown in Nigeria, soil and water management, and the transformation of the farming systems. The institutes that conduct crop research include the Institute for Agricultural Research, Zaria (IAR); Institute of Agricultural Research & Training (IAR&T); National Cereals Research Institute (NCRI); National Horticultural Research Institute (NIHORT); National Root Crops Research Institute (NRCRI); Lake Chad Research Institute (LCRI); Nigerian Institute for Oil Palm Research (NIFOR); Rubber Research Institute of Nigeria (RRIN); and the Cocoa Research Institute of Nigeria (CRIN).

- **Fisheries and Oceanography Research:** Research focuses on fisheries and other marine animals; effective and sustainable management of fisheries resources through improved post-harvest preservation, utilization and storage processes, and the physical characteristics of Nigerian coastal and ocean environment. The institutes involved include the National Institute for Freshwater Fisheries Research (NIFFR) and the Nigerian Institute of Oceanography and Marine Research (NIOMR).

- **Livestock and Veterinary Services Research**: Research focuses on the genetic improvement, production, and processing of common local domesticated animals; research into all aspects of animal diseases, their treatment, and control, as well as the development and production of animal vaccines and sera. The institutes under this category include the National Veterinary Research Institute (NVRI) and the National Animal Production Research Institute (NAPRI).

- **Agricultural Management, Capacity Building, and Extension Services:** Research focuses on technology transfer and adoption studies; overall planning and development of extension liaison activities country-wide; collation and evaluation of agricultural information; management of post-harvest food handling and preservation; improvement of food storage

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[4] The Steve Oronsaye Report categorizes the research areas of the NARIs into four – Crop, Fisheries and Oceanography, Livestock and Veterinary Services, and Agricultural Management, Capacity Building and Extension Services.

structures, processing and packaging equipment, and skill and capacity building in postharvest technology. The institutes under this category include the National Agricultural Extension and Research Liaison Services (NAERLS) and Nigerian Stored Products Research Institute (NSPRI).

The national mandates of the NARIs provide an overarching frame for the research focus of the institutes, and they do not typically conduct research outside their national mandate areas. However, on analysis of the data received from the NARIs, Sahel identified several cases over the past six (6) years where the IAR, Zaria, conducted research on rice and soybean, two crops outside its national mandate crops. Similar incidences were, however, not identified across the other NARIs.

Sahel aggregated responses from all eighteen researchers within the NARIs and one (1) respondent from ARCN and identified that within the national mandate of the NARIs, there are three major determinants of the specific research focus of the NARIs for a given period. According to the respondents, these include the national agenda or priorities for the agriculture sector, the needs of end-users, and the areas of interest of external funders such as donors and development organizations and private companies.

- **National Agenda for the Agriculture Sector:** The national agenda for the agriculture sector, as defined by the national agricultural policy in effect or by the administration at any given time, are pointers to focus areas of the government. As stated by researchers within the NARIs and the respondent from ARCN, this typically spurs the development of specific research proposals targeted at addressing key issues in these focus areas. The national agenda also influences research activities and studies by researchers within the NARIs that have the national mandates for these priority areas or crops.

- **Needs of End-users:** The researchers within the NARIs also stated that end-users' demands and needs inform the focus of proposals developed and submitted by researchers within the institutes. However, interviews with these researchers further revealed that most institutes lack adequate capacity to effectively engage end-users, particularly private sector companies, to ascertain their research needs or demands, ultimately impacting research planning. This inadequate capacity of the institutes is usually due to limited funding and weak extension and monitoring and evaluation units. Therefore, it is not surprising that the four (4) respondents interviewed from indigenous private seed companies and processing companies and the two (2) respondents from farmer associations, who are key end-users of research products from the NARIs, reported that research from the NARIs is not demand-driven and market-oriented as it fails to address their research needs.

- **Funding from External Sources:** Funding from external sources, such as donor and development organizations, to the NARIs for agricultural research through research programmes also influences the research focus of the NARIs, according to respondents. However, the funder usually determines the choice of the research focus area to be funded.

Collaboration between the NARIs and Other Actors within the NARS

The NARIs have partnerships with actors in the NARS, including other NARIs, educational institutions, international research institutes, the ADPs, and some private organizations to conduct research activities and disseminate research findings to end-users.

Among the NARIs, Sahel's field research revealed conflicting views regarding their collaboration with each other. While all researchers interviewed within the crop focused NARIs stated that the institutes have strong partnerships with each other to conduct research, particularly when research is focused on similar mandate crops, respondents within some non-commodity research institutes believed the collaboration among the NARIs was limited, especially between the commodity and non-commodity research institutes. For example, there is a weak collaboration between the NSPRI and other NARIs focused on genetic improvement of key commodities such as cassava, rice, maize, yam, soybean, etc. The two (2) researchers within NSPRI interviewed for this study stated that the commodity institutes often work in silos and are largely unaware of the specific research products developed by the NSPRI, which could positively impact their activities.

Interview respondents within the NARIs, educational institutions, and CGIAR centres in Nigeria stated the existence of strong partnerships with each stakeholder group in the conduct and transfer of research to end-users. The NARIs partner with educational institutions that conduct agricultural research in Nigeria, particularly the specialized Universities of Agriculture, to develop research grant proposals, conduct research, and transfer findings to farmers, as stated in Box 1.

Box 1. – Collaboration between the NARIs and Educational Institutions in Nigeria

Several educational institutions in Nigeria have strong collaborations with the NARIs and play key roles in agriculture research in Nigeria. Nigeria's first-generation universities, University of Ibadan, University of Nigeria, Nsukka, University of Ife (now Obafemi Awolowo University) and Ahmadu Bello University, Zaria established between 1948 and 1962, had agriculture as one of their pioneering faculties, dedicated to the study of agriculture and agricultural research, given the agrarian focus of the economy before the oil boom of the 1970s.

Some of these first-generation universities still have strong affiliations with the NARIs. The Ahmadu Bello University in Zaria currently houses three NARIs, the Institute for Agricultural Research (IAR), National Animal Production Research Institute (NAPRI) and the National Agricultural Extension & Research Liaison Services (NAERLS). In the same vein, the Obafemi Awolowo University in Ife also administratively supervises the Institute of Agricultural Research and Training (IAR&T) in Ibadan. Some researchers at IAR and IAR&T are also members of the faculty of agriculture at their affiliated educational institutions and deliver lectures to students.

In addition to the first-generation universities, the Federal Government of Nigeria (FGN), through the Federal Universities of Agriculture Act of 1992, has also established three (3) agriculture-focused universities to further support agricultural research in Nigeria. These are, the Federal University of Agriculture, Abeokuta in Ogun state; Federal University of Agriculture, Makurdi in Benue state; and Michael Okpara University of Agriculture, Umudike in Abia State. According to the four (4) researchers interviewed for this study, across the three (3) universities, the universities collaborate with the NARIs to develop research proposals, conduct research, and support the transfer of research to end users.

The NARIs also work with the CGIAR centres to conduct research and disseminate findings to end-users. Based on insights from field research, the NARIs and CGIAR centres with similar research

priority areas often jointly develop and submit research proposals and bids for the opportunity to implement donor-funded research programmes in Nigeria. The NARIs, in conjunction with educational institutions, also collaborate with the CGIAR centres to develop and release several improved crop varieties.[5] For instance, there have been several collaborations between IITA and the Africa Rice Center with NRCRI, IAR, IAR&T and NCRI to develop and release new varieties of cassava, yam, rice and maize.

Based on their national mandates and the focus of the research programmes, the NARIs are often designated as implementing partners on research programmes funded by donors and implemented by the CGIAR centres or on CGIAR research programmes. This is evident in various past and ongoing research programmes in the country, such as the two phases of the Yam Improvement for Income and Food Security in West Africa (YIIFSWA) and the Building an Economically Sustainable Integrated Seed System for Cassava (BASICS) Projects, with IITA and NRCRI as implementing partners. The NARIs also work with other CGIAR centres other than those with offices in Nigeria, such as the International Maize and Wheat Improvement Centre (CIMMYT), which has supported agricultural research efforts in Nigeria through donor-funded programmes on crop genetic improvement.

The NARIs also partner with private sector organizations to conduct agricultural research. However, the level of engagement is minimal and less frequent, given the limited involvement of private sector organizations in public agricultural research. Interviews with five (5) private sector companies revealed that the agricultural industry's needs determine collaborations between the private sector and research institutes. For instance, Nigerian Breweries Plc, the largest brewing company in Nigeria, has supported the development of sorghum varieties in Nigeria, which is a major component of its beer products. Between 2003 and 2012, the company partnered with IAR, the NARI with the national mandate for sorghum, and the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) to develop sorghum varieties with specific characteristics that are suitable for its product development, such as nutritional value, grain size, and yield. This led to the development and commercialization of four (4) sorghum varieties in Nigeria that are publicly available across the country.

Private indigenous and multinational seed companies also collaborate with the NARIs to conduct multi-location trials for their seed varieties, either developed from their research or which they have obtained licenses from CGIAR centres to produce. Whether the varieties are developed by companies or CGIAR centres, seed companies must collaborate with NARIs to meet the national requirement for the development and release of new varieties by the National Varietal Release Committee in Nigeria.[6] However, these varieties are privately bred as the seed companies retain licenses to the varieties. Sahel's field research also indicated that the NARIs collaborate with private sector organizations which are designated implementing partners on donor-funded agricultural research programmes.

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[5] The Varietal Catalogue developed by the National Centre for Genetic Resources and Biotechnology includes all the crop varieties developed by the NARIs and CGIAR centres in Nigeria and approved for release by the National Varietal Release Committee in Nigeria

[6] According to the guidelines for the registration and release of new crop varieties in Nigeria, if crop varieties are developed by organizations other than the NARI with the related national mandate, the organization must work harmoniously with the related NARI to evaluate the variety. All crop varieties nominated for release must be routed to the National Varietal Release Committee through the related NARI.

In the provision of extension services, the NARIs have extension departments that engage primarily with the state ADPs to disseminate research findings and modern technologies such as improved seeds, fertilizers, crop protection products, livestock, and good production practices to farmers. Also, NAERLS, the NARI with the national mandate to coordinate extension and research liaison activities in Nigeria, works closely with the ADPs to ensure the effective dissemination of research findings to end-users. According to Arokoyo, T. (2019) and as corroborated by interview respondents within the NARIs and educational institutions, the NARIs are also actively involved in Monthly Technology Review Meetings (MTRM), which are hosted by the state ADPs, to obtain feedback on research products. During these meetings, representatives from the NARIs provide coordination support, observe the performance of research products via field inspections, and engage in discussions with participants, including stakeholders from farmer organizations, educational institutions, and private sector organizations. However, insights from respondents within the NARIs revealed that the frequency of the MTRM has been reduced to quarterly meetings or cancelled due to the limited capacity of the ADPs.

As evident in the paragraphs above, the NARIs have strong partnerships with stakeholders in the NARS to conduct core research activities based on their national mandates and ensure the dissemination of research among end-users in the country. The strength of these partnerships shapes the impact of the NARIs and determines the efficiency of the NARS.

Chapter Summary
- The NARIs in Nigeria conduct agricultural research across four key areas, Crop; Fisheries and Oceanography Research; and Livestock and Veterinary Services and Agricultural Management, Capacity Building and Extension Services.
- The national mandate of each NARI determines its research focus. Within their national mandates, the three major determinants of the specific research focus of the NARIs for a given period include the national agenda or priorities for the agriculture sector, the needs of end-users, and the areas of interest of external funders such as donors and development organizations, and private companies.
- The NARIs collaborate with actors within the NARS, including other NARIs, educational institutions, international research institutes, the ADPs, and some private organizations to conduct research activities and disseminate research findings to end-users.

FUNDING TRENDS OF AGRICULTURAL RESEARCH AND DEVELOPMENT IN NIGERIA AND ACROSS RESEARCH PRIORITY AREAS

This chapter will focus on the funding environment for agricultural research and development in Nigeria between 2014 to 2019 across the NARIs, focusing mainly on the information received from the NARIs, international research institutions and donor organizations. It will also include an analysis of the focus impact areas of research programmes across specific priority commodities within this timeframe.

Funding for Agricultural Research and Development

The actors that provide funding for public agricultural research and development activities in Nigeria include the Federal Government of Nigeria (FGN), donor and development organizations, and a few private sector organizations.

A. Federal Government Funding for Agricultural Research and Development

The FGN provides funding to the NARIs and some educational institutions that conduct agricultural research in Nigeria.

- **Funding to the NARIs:** Annually, the FGN appropriates and disburses funding to the NARIs for public agricultural research. Each institute is responsible for preparing its annual budget, detailing its funding requirements for the year, and ensuring submission to its supervising ministry. FMARD conducts a review of the submitted budgets that are then consolidated in the ministry's total budget and submitted to the Federal Ministry of Finance, Budget, and National Planning (MFBNP) for further review and approval. After additional review by other government arms and upon the assent of the budget by the President, the approved funds are disbursed by the MFBNP to NARIs for utilization for the approved budget line items.[7] The NARIs have complete autonomy over the utilisation of the allocated funds within the scope of their stated research objectives.

- **Funding to Educational Institutions:** The FGN appropriates and disburses annual funding to public educational institutions for educational activities. For core research activities in educational institutions including agricultural research, in 2011, the FGN introduced the Tertiary Education Trust (TET) fund generated primarily from a 2% education tax requirement of the accessible profits from companies registered in Nigeria. Through the TET fund, researchers within the educational institutions can access funding for research, including agricultural research.

Trends in Government Funding Appropriation and Disbursement for Agricultural Research and Development

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[7] The ARCN recently proposed in the ARCN (Repeal and Enactment) Bill 2019 (HB. 69), its involvement in the budget preparation process of the NARIs, to ensure alignment with national research priorities and oversight over the fund allocation and disbursement process.

Government Funding Appropriation

The total funding appropriated to the NARIs by the FGN is based on the budgets of the institutes. During the review of the budgets of NARIs by the arms of government and before assent by the president, legislators representing a particular constituency may also suggest the inclusion of additional funding to the NARIs to support specific projects in their constituencies that the related NARIs could address. However, this is not specific to the agriculture sector in Nigeria.

The budgets submitted by the NARIs largely determines the amounts appropriated to the institutes. The figure below shows the total funding appropriated to the eight (8) focus NARIs and the funding growth rate between 2014 and 2019.
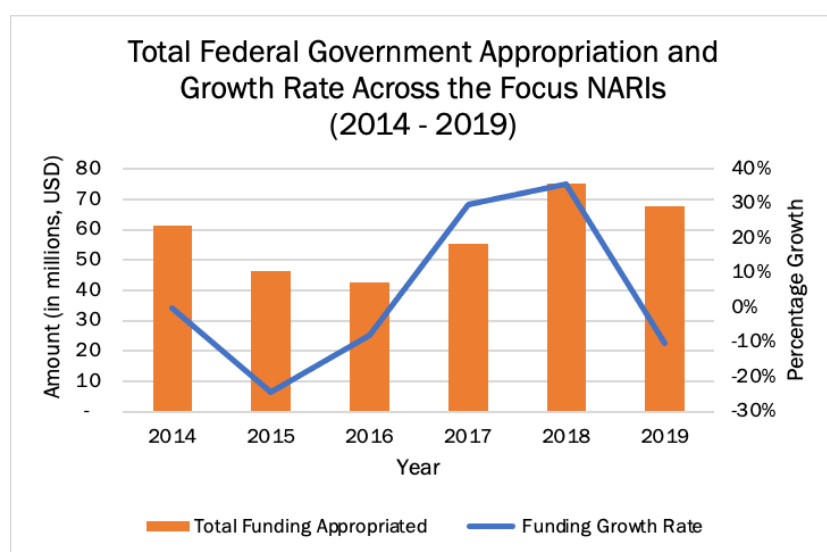
Figure 2 - Total Federal Government Funding Appropriation to the NARIs

Government Funding Disbursements

As reported by Ayoola, G.B., and Abdullahi, A.S., (2011) in their study on nationally financed agricultural research in Nigeria, and as evident in the data provided by the NARIs, funding disbursed to the institutes is usually lower than the amounts appropriated in the approved national budget.[8]

Also, researchers at the NARIs cited frequent delays in the annual funding disbursements, which are in some cases released towards the end of the year, limiting the ability to conduct timely research. Data received from the NARIs further confirmed multiple instances of delayed funding disbursements for research projects across several years and various institutes.

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[8] In some cases, the NARIs may also receive funding disbursements higher than amounts stated in their annual budgets, due to the inclusion of funding for constituency projects.

The chart below shows a comparison of the funding appropriated and disbursed by the FGN to the focus NARIs from 2014 to 2019:
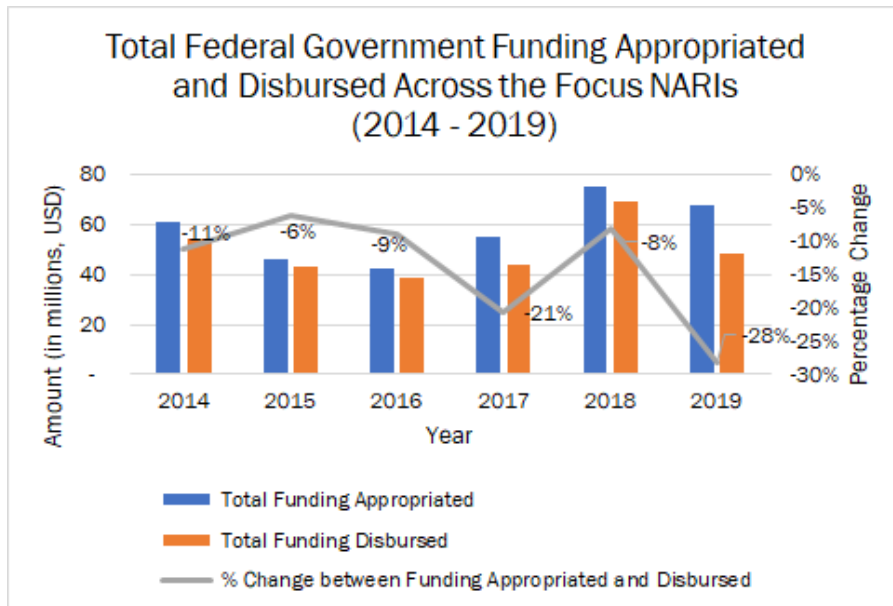
Figure 3 - Total Federal Government Funding Appropriated and Disbursed Across the Focus NARIs (2014 - 2019)

The charts in Box 2 show a breakdown of total funding appropriated and disbursed by the FGN to the eight (8) NARIs between 2014 and 2019.

Box 2: Breakdown of Total Funding Appropriated and Disbursed by the Federal Government of Nigeria to the NARIs between 2014 and 2019

Institute of Agricultural Research & Training

Institute for Agricultural Research

National Root Crops Research Institute

National Horticultural Research Institute

National Cereals Research Institute

National Institute for Freshwater Fisheries Research

Nigerian Stored Products Research Institute

National Agricultural Extension and Research Liaison Services

As evident in Box 2, trends in disbursements across the six (6) years show that amounts appropriated by the FGN often differs from the amount received by the NARIs. However, in some years and across certain NARIs such as the National Cereals Research Institute in 2014, the National Root Crops Research Institute in 2015, the National Institute for Freshwater Fisheries in 2016, and the Institute for Agricultural Research between 2016 and 2018, amounts appropriated are closely aligned with amounts disbursed.

Despite the common trend of higher funding appropriations than disbursements from the FGN across the NARIs, the data analysis revealed a different trend in the funding appropriation and disbursements to two institutes, the Nigerian Stored Products Research Institute (NSPRI) and the National Agricultural Extension and Research Liaison Services (NAERLS). As shown in the chart on NAERLS, the institute consistently received the exact amounts appropriated by the FGN each year. Given that this phenomenon is unusual compared to the other NARIs, the case of NAERLS may be attributed to the quality of data received from the institute.

On the other hand, in 2016, the NSPRI received disbursements higher than its appropriated amount. Its appropriated amount increased by over 100% between 2017 and 2019, compared to 2016, and recorded higher disbursements between 2018 and 2019. Sahel's engagement with the accounts department of NSPRI revealed that in some years between 2014 and 2019, the institute also received additional funding from the FGN outside its budgeted amount to undertake constituency projects within its mandate area.

Components of Government Funding Disbursed to the NARIs

The categories of funding from the FGN to NARIs include personnel, overhead, and capital costs. The figure below shows the components of funding disbursed to the NARIs by the FGN between 2014 to 2019:[9]
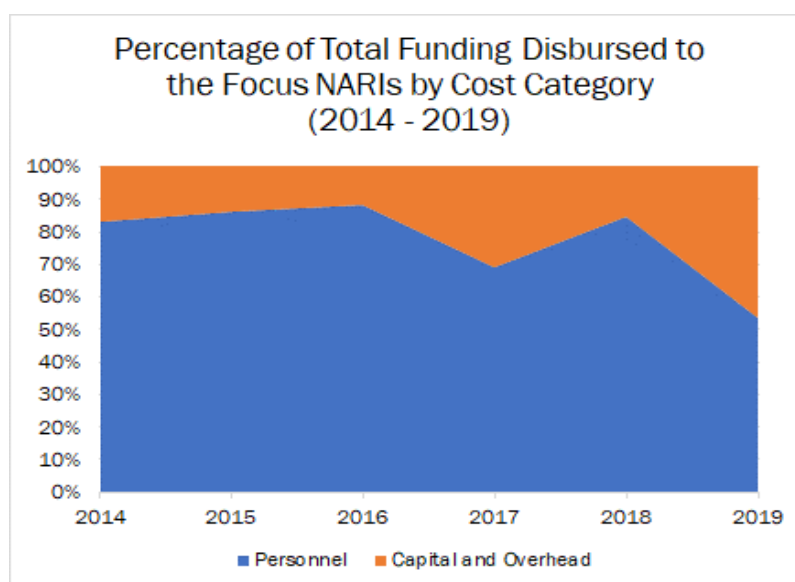
Figure 4 - Percentage of Total Funding Disbursed to the Focus NARIs by Cost Category

Overall, personnel costs account for the highest component of funding disbursed to the NARIs. Between 2014 and 2018, personnel costs accounted for between 70 – 80% of total funding from

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[9] This is not inclusive of costs from the Institute for Agricultural Research, Zaria as the Sahel team did not receive a breakdown of costs by category from the institute.

the FGN to the NARIs. In 2019, personnel costs dropped to about 50% of the total funding disbursed to the NARIs. This reduction may imply a growing increase in the focus on capital projects, which includes research programs and infrastructure projects as stated in the budgets of the NARIs.[10] However, the Sahel team faced data limitations in obtaining the breakdown of funds received across the three categories from all NARIs and grouped capital and overhead costs in the data analysis. As such, growth trends in the capital and overhead costs across the six (6) years are not evident.

B.   Donor and Development Organizations Funding Assistance for Agricultural Research and Development

Beyond the funding provided by the FGN for public agricultural research in Nigeria, donor organizations are also major funders of agricultural research through the provision of grant funding for agricultural programmes. Some agricultural programmes either include research as components or are focused solely on research activities, with research institutes as implementing partners.

Funding from donor and development organizations for agricultural research is usually provided directly to grantees or implementing partners of research programmes, including the NARIs, educational institutions, and some private organizations. However, unlike annual funding allocation from the FGN for agricultural research, funding assistance from donors is unpredictable as it is based on donor priorities and provided for the duration of the programmes.

Donor Funding to the NARIs

Based on the data shared by NARIs, donor and development organizations provided over 6.1 million USD to the institutes for agricultural research between 2014 and 2019. The table below highlights the annual funding from donor to the focus NARIs, from 2014 – 2019:[11]

Table 1 - Total Funding from Donors and Development Organizations to the Focus NARIs (2014 - 2019)

Total Funding from Donors and Development Organizations to the Focus NARIs for Agricultural Research (in '000, USD)						
Research Institute	2014	2015	2016	2017	2018	2019
IAR&T	213	276	118	75	16	79
NIHORT	-	-	-	48	76	68
NCRI	246	-	-	-	329	130
NSPRI	-	134	-	8	36	55
IAR	313	472	802	351	402	693
NAERLS	-	-	-	63	89	1,042
Total	772	882	921	545	949	2,067

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[10] The reduction in the growth trend for personnel costs may also be attributed to the management of personnel payments such as salaries and wages to all Federal Government employees, including the employees at the NARIs, through the Integrated Payroll and Personnel Information System (IPPIS) platform. The IPPIS platform was introduced by the Federal Government to improve the effectiveness and efficiency in the storage of personnel records and administration of monthly payroll, to enhance confidence in staff emolument costs and budgeting. According to Sahel interviews, the NARIs have, within the past year, been migrated to the IPPIS platform to receive salaries and wages directly from the government, while some NARIs had been migrated to the platform since 2014. It is not far-fetched that the migration to the IPPIS platform has helped in identifying ghost workers and cutting personnel costs that should not be incurred, thus reducing the amount spent on personnel payments at the NARIs.

[11] The table reports data for only six (6) out of the eight (8) focus NARIs for this study. The NARIs not included are the National Institute for Freshwater Fisheries Research (NIFFR) and the National Roots Crops Research Institute (NRCRI). The NIFFR did not receive any donor funding between 2014 and 2019 and although the NRCRI received funding from donors, the institute did not share any data on donor funding received within the timeframe with the Sahel team.

The chart below shows a breakdown of funding received by the focus NARIs as a percentage of funding provided by donor and development organizations to these NARIs between 2014 and 2019.
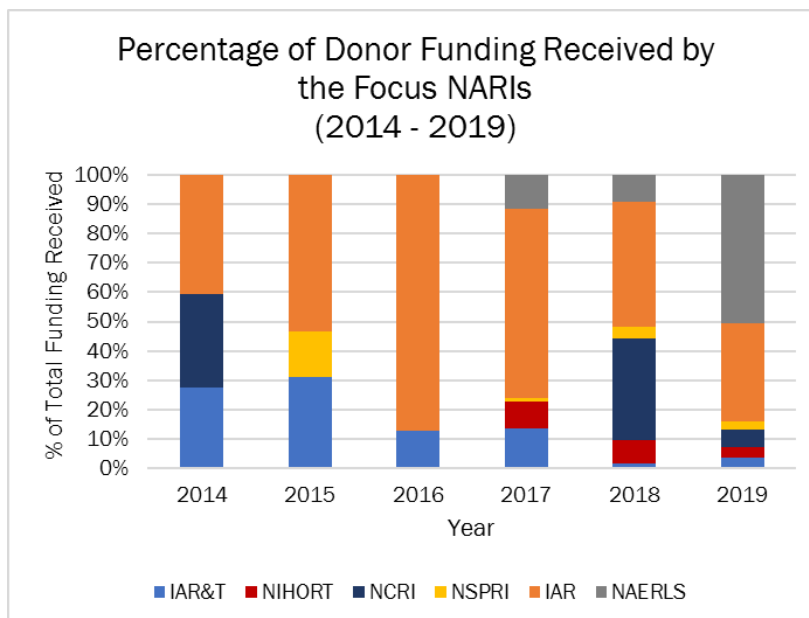
Figure 5 - Percentage of Donor Funding Received by the Focus NARIs (2014 - 2019)

As shown in the table and figure, NARIs such as IAR and IAR&T consistently received funding between 2014 and 2019, although in different variations. Both research institutes have the mandate to research major cereal and legume crops in Nigeria. The consistent funding to IAR and IAR&T is indicative of the commitment of donors in supporting the development of value chains within the national research mandates of both institutes, such as maize.

Also, institutes such as NIHORT, NCRI, NSPRI, and NAERLS[12], which have the mandate for fruits and vegetables, cereals such as rice and soybean, stored products research, and extension services, respectively, received funding from donors, however in an inconsistent manner.

The NIFFR, which has the mandate for freshwater fisheries, did not report any donor funding between 2014 and 2019, implying that freshwater fisheries research is not a priority area for donors and development organizations.

Donor Funding to Educational Institutions

Donor and development organizations also engage educational institutions to implement agricultural projects with research components. These educational institutions are either

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[12] While the institute received donor funding between 2017 and 2019, funding received in 2019 does not align with the trends of donor funding received in the previous years. In 2017 and 2018, NAERLS received about 10% annually, of the total donor funding to the focus NARIs. However, the institute reported about 50% of the total funding provided by donors to the focus NARIs in 2019. Upon further analysis of the data provided by the institute, the Sahel team identified that NAERLS received over 1 million USD for one (1) research project in 2019. Given the lack of alignment with the trends in the receipt of donor funding in the previous years, the team engaged the institute to obtain further clarification but did not receive any response from the institute.

specialised universities of agriculture, universities affiliated with NARIs or universities with agriculture faculties. The Sahel team identified instances of funding from donors for projects with research components to educational institutes.

Between 2014 and 2019, the BMGF provided over 4.6 million USD to eight (8) universities in Nigeria to implement agricultural projects with research components. Given that educational institutions are not bound by national research mandates for specific crops or commodities, the focus of these projects has cut across several value chains to support projects on crop and livestock genetic improvement, production, monitoring, and evaluation. The details of these projects are presented in the table below:

Table 2 - Funding to Educational Institutions from the BMGF (2014 - 2019)

Funding to Educational Institutions from the BMGF (2014 - 2019)		
Institution	Project Name	Amount
University of Ibadan	PEARL I: Sustainable Cowpea production for rural smallholder farmers in Nigeria	$ 492,478
Obafemi Awolowo University	CROSS-CUTTING: Nigeria Country Plan Baseline and Varietal Monitoring Survey	$ 1,499,998
Ahmadu Bello University	PEARL 2: Genetic Improvement of Cowpea for Low Soil Phosphorus Tolerance	$ 486,732
Kebbi State University of Science and Technology, Aliero	PEARL I: Building Local Capacity for Surveillance, Diagnosis, Characterisation and Control of Cassava Viruses in Northern Nigeria	$ 499,726
Kebbi State University of Science and Technology, Aliero	PEARL 2: Improving Our Understanding and Response to Yam Badnaviruses Impacting Yam Growers in Northern Nigeria	$ 499,560
University of Calabar	PEARL 2: Biotechnology Approach for Producing Disease Free High-Performing Yam Seedlings	$ 499,936
Federal University of Agriculture, Abeokuta	PEARL I: Evaluation, Characterization, and Multiplication of high-producing local chicken germplasm for semi-scavenging productivity growth in West Africa #Livestock R&D	$ 196,570
Bowen University	PEARL 2: Developing Indicators for Phenotyping Food Quality Traits in Yam	$ 498,080
Total		$ 4,673,080

Source: Bill and Melinda Gates Foundation (2021)

C. Private Sector Funding for Agricultural Research and Development

As highlighted in previous chapters, the involvement of private sector organizations in agricultural research is minimal. The majority of private organizations that have supported agricultural research partnered with the CGIAR centres, and only a few companies have collaborated with the NARIs. Some large indigenous companies and multinationals in Nigeria have provided funds to research institutes to conduct research based on their specific needs and business objectives. Between 2014 and 2019, private sector organizations provided about 715,000 USD in total to the focus NARIs. The table and figure below highlight the distribution of funding from private sector organizations among the focus NARIs for agricultural research between 2014 and 2019:[13]

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[13] Only three (3) out of eight (8) NARIs reported receiving funding from the private sector between 2014 and 2019.

Total Funding for Agricultural Research to the Focus NARIs from Private Sector Organizations (in '000, USD)						
Research Institute	2014	2015	2016	2017	2018	2019
IAR&T	-	-	-	-	-	31
NIHORT	-	-	-	6	-	-
IAR	84	17	71	134	211	162
Total	84	17	71	139	211	193

Percentage of Total Funding Disbursed to the Focus NARIs by Funding Source

The figure below shows the percentage of total funding disbursed by the three funding sources to the focus NARIs from 2014 to 2019, as reported by the NARIs:
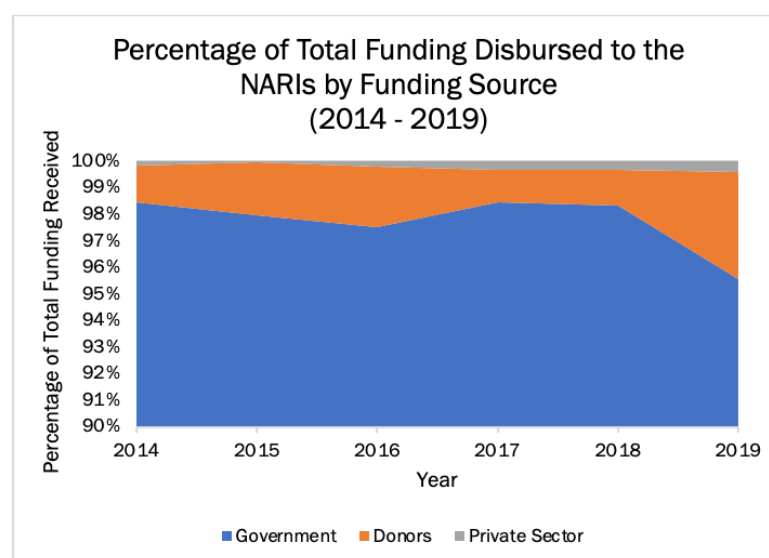
Figure 6 - Percentage of Total Funding Disbursed to the NARIs by Source

Overall, the FGN remains the largest funding source for agricultural research across the NARIs. Between 2014 and 2019, funding from the FGN ranged from 94 – 98% of the total funds disbursed for agricultural research to the focus NARIs. Donor and development organizations were the second major funding source for agricultural research to the focus NARIs, providing between 1.4 – 4.7% of total funding. In comparison, the private sector's funding accounted for less than 1% of the total funding to the focus NARIs within the specified timeframe.

Spotlight: The International Institute of Tropical Agriculture (IITA)

IITA conducts research on key staple crops, including banana, plantain, cassava, yam, cowpea, maize, and soybean in Nigeria and the sub-Saharan region. Based on the CGIAR Nigeria Site Integration Plan (2016), IITA's research in Nigeria aims to reduce rural poverty, improve food security, nutrition and health, and sustainably managing natural resources. Given its status as the largest CGIAR centre in Nigeria and its research focus on key crops important for food security, Sahel obtained data from IITA on its research projects in Nigeria. Between 2014 and 2019, IITA received over 100 million USD from three (3) sources: donor and development organizations, private sector organizations, and the Nigerian government.

The table and chart below show the trends in funding received by IITA for agricultural research in Nigeria from 2014 – 2019:

Table 4 - Total Funding Allocated to IITA for Agricultural Research in Nigeria by Source

Total Funding Allocated to IITA by Funding Source from 2014 - 2019 (in millions, USD)							
Funding Source	2014	2015	2016	2017	2018	2019	Total
Donor/Development Organizations	8.5	15.2	14.9	15.3	14.8	17.0	85.8
Private Sector	2.2	2.4	1.9	1.7	1.2	1.1	10.4
Public Sector	1.5	1.4	0.2	0.2	0.3	0.2	3.8
Total	12.2	19.0	17.0	17.2	16.3	18.3	100.0
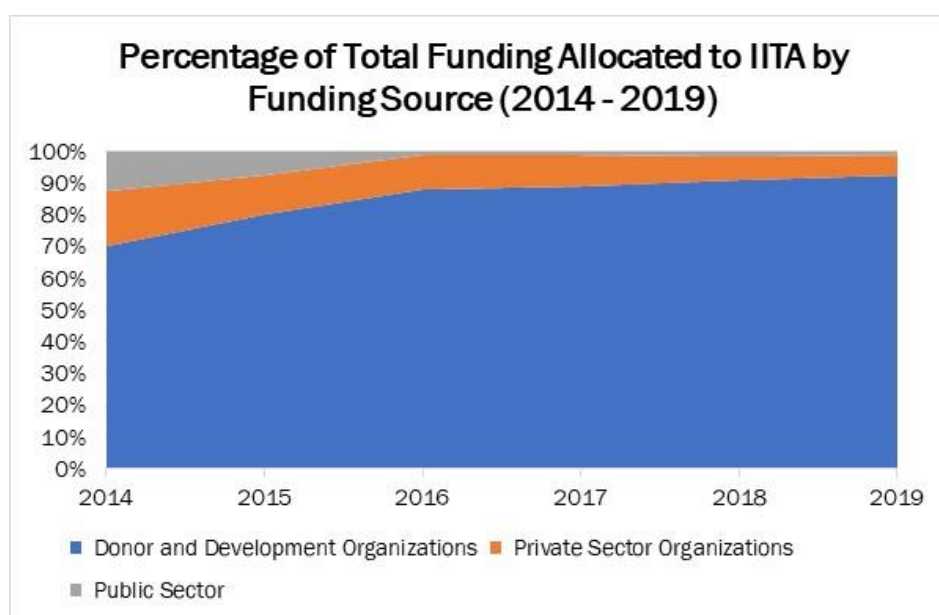
Figure 7 - Percentage of Total Funding Allocated to IITA by Source

The trends for agricultural research funding received by IITA paints a different but unsurprising picture when compared to funding trends across the NARIs. While the FGN is the largest funder of agricultural research to the NARIs, followed by donor and development organizations, with minimal contribution from the private sector, funding trends for IITA highlight donor and development organizations as the largest funder for agricultural research, providing over 85% of the total funding from 2014 - 2019. IITA generated most of its funding from donors for agricultural research in Nigeria due to its prominence and research capability. The institute leads the implementation of many donor-funded research programmes in Nigeria and collaborates with the NARIs as implementing partners. Private sector organizations served as the second major source of funding to the institute, providing over 10% of the total funding received by IITA within this period. In comparison, funding from the Nigerian government only constituted 3.8% of the total budget.

However, it is important to point out that amounts used in the analysis for IITA are estimated amounts as stated by the funders at the signing of the project contract with the institute. Given the multiple research projects implemented by IITA, the institute did not provide information on actual amounts disbursed for each research project, especially when allocated amounts were either increased or reduced by funders during project implementation.

Funding Trends Across Focus Impact Areas

The Sahel team also obtained data from the NARIs and IITA on research projects between 2014 and 2019 to identify funding trends across the research impact areas of focus in this study – productivity, nutrition, climate resilience, and sustainability. The Syngenta Foundation and Sahel teams defined the interdependent impact areas as follows:

- **Productivity:** Research geared towards improving crop productivity to ensure the production of adequate food for consumption, such as research on agronomic and pathological characteristics like yield, pest, and disease resistance and research focused on improved processing methods.
- **Nutrition:** Research focused on enhancing the nutritional value of crop and food products, such as the addition of added nutrients in crop varieties and processed food products.
- **Climate Resilience:** Research focused on ensuring resilience and survival of crops and livestock against harsh weather conditions.
- **Sustainability:** Research focused on managing natural resources such as soil and water to support land cultivation for food production.

The Sahel team focused the analysis on impact areas around various food crops and fisheries, based on information from the research institutes. For food crops, the team analysed the category of fruits and vegetables and five other major crops in Nigeria – maize, rice, cassava, yam, and soybean - across the cereal, root, and tuber, and legume crop categories. The rationale for selecting the five (5) major crops is due to their level of cultivation and consumption in Nigeria. Although according to the Living Standards Measurement Study – Integrated Surveys on Agriculture (2018/2019), the major crops cultivated by farmers in Nigeria are maize (49.7%), cassava (46.2%), sorghum (29.6%), yam (25.8%), and cowpea (20.9%), the Sahel team replaced sorghum and cowpea with rice and soybean, respectively. The replacement of sorghum with rice is due to the importance of rice in the diet of the population in Nigeria, while the replacement of cowpea with soybean is due to its importance as a key source of food for household and animal nutrition and its industrial use. Four (4) of the selected crops – cassava, maize, rice, and soybean - are also priority crops of the FGN as outlined in the APP.

Across all the crop and commodity categories, the Sahel team analysed the data based on an aggregate of spending on each category across the country to highlight spending trends in the focus impact areas of productivity, nutrition, climate resilience, and sustainability. The team also made assumptions in analysing the data across the impact areas of focus, as stated earlier in this report.

Root and Tubers

Sahel analysed the data received from NRCRI, the only NARI with the national mandate for root and tuber crops in Nigeria, and IITA, which also has the mandate for cassava and yam, to identify the funding and spending trends for the crops in Nigeria, and across the focus impact areas.

However, the data on the contributions from donor and development organizations and the private sector for cassava and yam are not inclusive of amounts received by the NRCRI from these funding sources due to the institute's reluctance to share the data. As such, the data on funding from donor and development organizations and private sector organizations analysed and included under this section is based solely on data obtained from IITA.

Box 3: Cassava – Funding Trends by Funding Source and Across Impact Areas

The table below details the estimated amount spent by the research institutes responsible for cassava research in Nigeria, across the impact areas of productivity, nutrition, climate resilience, and sustainability while the charts below show the funding trends by impact areas across 2014 and 2019.

Table 5 - Funding Trends for Agricultural Research on Cassava by Source and Impact Areas

Funding Trends for Agricultural Research on Cassava by Funding Source and Impact Areas (in '000, USD)																			Total
	2014			2015			2016			2017			2018			2019			
	FGN	Donors	Priv. Sec	FGN	Donors	Priv. Sec	FGN	Donors	Priv. Sec	FGN	Donors	Priv. Sec	FGN	Donors	Priv. Sec	FGN	Donors	Priv. Sec	
Productivity	1,603	1,834	642	1,411	4,002	511	184	3,869	92	203	3,750	3	673	3,596	3	426	3,747	3	26,552
Nutrition	69	721	25	-	1,478	-	-	1,455	-	-	1,473	-	518	1,473	-	-	1,361	-	8,572
Sustainability	-	150	-	-	858	-	-	727	-	37	727	-	43	727	-	20	728	-	4,016
Climate Resilience	12	-	-	-	-	-	-	-	-	37	4	-	43	4	-	20	4	47	170
Others	-	-	-	-	-	33	-	-	33	-	-	33	-	58	47	-	72	47	323
Total	1,684	2,705	667	1,411	6,337	544	184	6,050	124	277	5,953	36	1,278	5,858	50	465	5,912	98	39,633
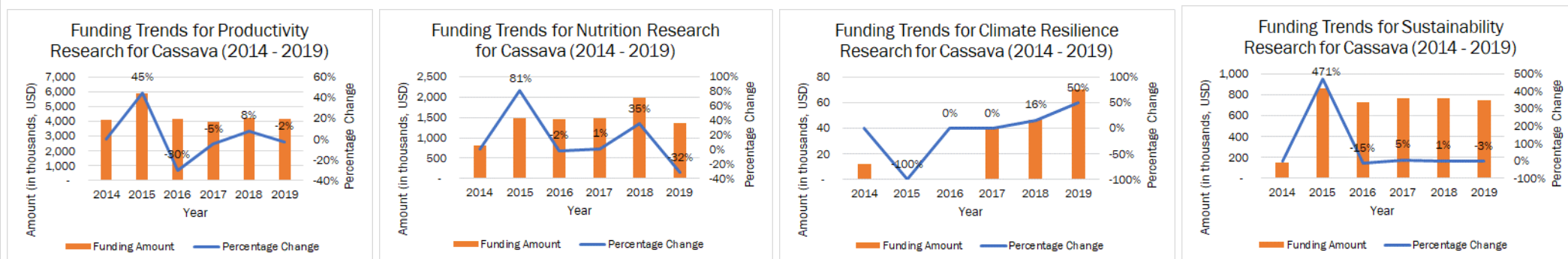
Figure 8 - Funding Trends for Cassava Research by Impact Areas

About 66% of the estimated amount spent on projects for cassava in Nigeria between 2014 and 2019 was directed towards crop productivity improvement research. This is followed by nutrition improvement research at over 21%, sustainability at 10%, and climate resilience at 0.42% of the total funding received across the six years. While the impact areas of productivity, nutrition, and sustainability consistently received funding since 2014, funding for research to enhance the climate resilience of the crop was not consistent, until 2017 when the impact area received consistent funding, including funding from the private sector in 2019.

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Box 4: Yam - Funding Trends by Funding Source and Across Impact Areas

The table below details the estimated amount spent by the research institutes responsible for yam research in Nigeria, across the impact areas of productivity, nutrition, climate resilience, and sustainability, while the charts below show the funding trends by impact areas across 2014 and 2019.

Table 6 - Funding Trends for Agricultural Research on Yam by Source and Impact Areas

Funding Trends for Agricultural Research on Yam by Funding Source and Impact Areas (in '000, USD)																		
	2014			2015			2016			2017			2018			2019			Total
	FGN	Donors	Priv. Sec	FGN	Donors	Priv. Sec	FGN	Donors	Priv. Sec	FGN	Donors	Priv. Sec	FGN	Donors	Priv. Sec	FGN	Donors	Priv. Sec	
Productivity	135	844	25	98	881	25	516	1,445	-	37	1,383	3	64	1,198	7	92	1,133	7	7,891
Sustainability	-	418	-	-	480	-	-	418	-	37	479	-	43	387	-	20	324	-	2,605
Nutrition	-	-	-	-	-	-	-	499	-	-	499	-	-	499	-	-	500	-	1,997
Climate Resilience	12	-	-	-	-	-	-	-	-	37	4	-	43	4	-	20	4	-	123
Others	-	7	-	-	7	-	-	-	-	-	-	-	-	-	-	-	-	-	13
Total	148	1,268	25	98	1,368	25	516	2,362	-	110	2,365	3	150	2,087	7	131	1,960	7	12,629
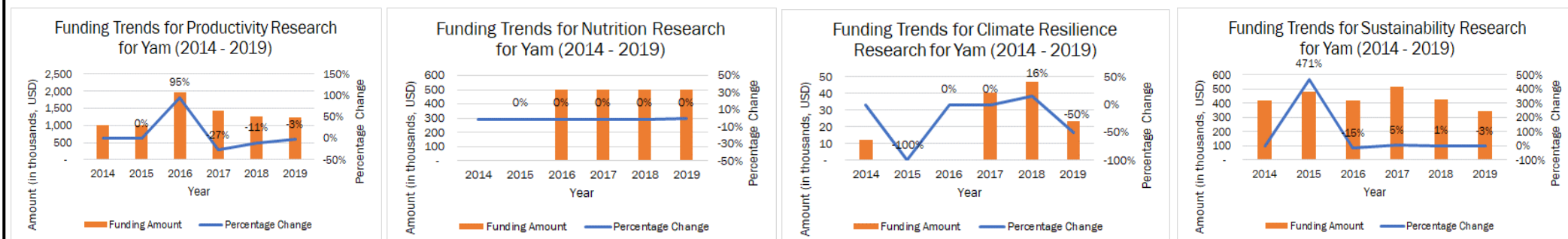
Figure 9 - Funding Trends for Yam Research by Impact Areas

Over 60% of the estimated amount spent on yam improvement research in Nigeria between 2014 and 2019 was directed towards improving the productivity of the crop. Based on the data received from the institutes, the impact area of productivity was consistently a key focus of research for yam. The second major research impact area based on funding received was sustainability as it relates to yam production. This is followed by the impact area of nutrition which received consistent funding for research since 2016. Research for the impact area of climate resilience received the least funding commitment overall, since 2014, although trends show consistent funding for the impact area since 2017.

For comparison across the two crops in the root and tuber category, Sahel further analysed the average funding spent on yam and cassava across the impact areas from 2014 to 2019. The chart below shows the average funding for cassava and yam across the impact areas:
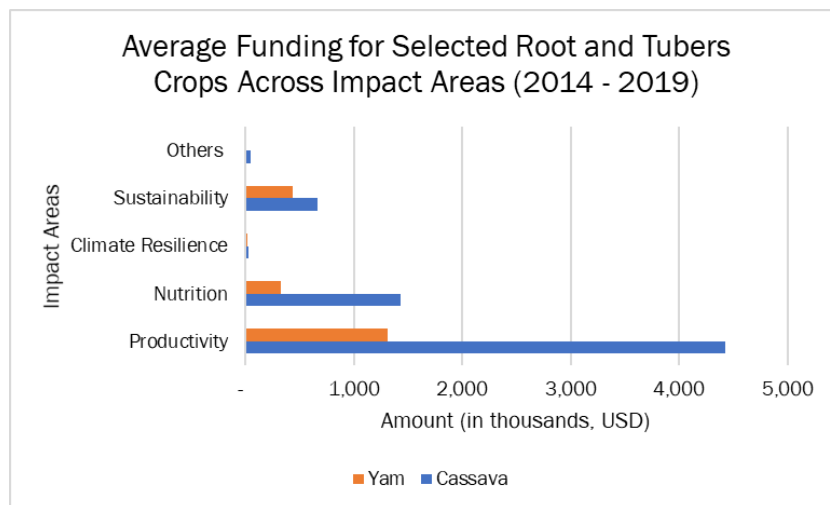
Figure 10 - Average Funding for Selected Root and Tuber Crops Across Impact Areas

On average, between 2014 and 2019, cassava received the most funding across all impact areas, compared to yam. The major similarity between both crops is evident in the impact area of productivity for which the two crops received the most funding on average, compared to the other impact areas. However, while the second most funded impact area for cassava was nutrition, this differs for yam as the second most funded impact area for the crop was sustainability. Funding for research on the impact area of climate resilience remains the lowest for the two crops.

Cereals

Under the cereal category, multiple NARIs, IITA and the Africa Rice Centre, are involved in agricultural research for rice and maize, the two selected crops under this category. For rice, Sahel analysed the data received from NCRI, the NARI with the national mandate for rice in Nigeria, information from IAR, the additional NARI that conducted rice research, IITA, and the Africa Rice Centre to highlight funding and spending trends for rice in Nigeria. Similarly, for maize, Sahel analysed the data received from both IAR and IAR&T, the two NARIs with the national mandate for maize in Nigeria, and IITA, to highlight funding and spending trends for the crop across Nigeria. For this category, Sahel analysed data from all the research institutes in Nigeria that are responsible for rice and maize research.

Box 5: Rice - Funding Trends by Funding Source and Across Impact Areas

The table below details the estimated amount spent by the research institutes responsible for rice research in Nigeria, across the impact areas of productivity, nutrition, climate resilience, and sustainability while the charts below show the funding trends by impact areas across 2014 and 2019.

Table 7 - Funding Trends for Agricultural Research on Rice by Source and Impact Areas

Funding Trends for Agricultural Research on Rice by Funding Source and Impact Areas (in '000, USD)																			Total
	2014			2015			2016			2017			2018			2019			
	FGN	Donors	Priv Sec.	FGN	Donors	Priv Sec.	FGN	Donors	Priv Sec.	FGN	Donors	Priv Sec.	FGN	Donors	Priv Sec.	FGN	Donors	Priv Sec.	
Productivity	37	7,212	-	4	2,203	-	6	1,958	-	39	1,183	-	21	1,166	-	3	1,333	-	15,164
Sustainability	4	5,701	-	2	1,251	-	2	1	-	39	200	-	21	7	-	3	5	-	7,235
Nutrition	34	67	-	2	1,251	-	4	106	-	39	-	-	18	163	-	3	352	-	2,038
Climate Resilience	4	57	-	2	1,251	-	2	1	-	39	-	-	21	7	-	3	32	-	1,419
Others	11	-	-	4	-	-	5	0	-	46	-	-	59	0	-	2	83	-	211
Total	**90**	**13,038**	**-**	**15**	**5,954**	**-**	**20**	**2,065**	**-**	**200**	**1,383**	**-**	**142**	**1,343**	**-**	**14**	**1,805**	**-**	**26,068**
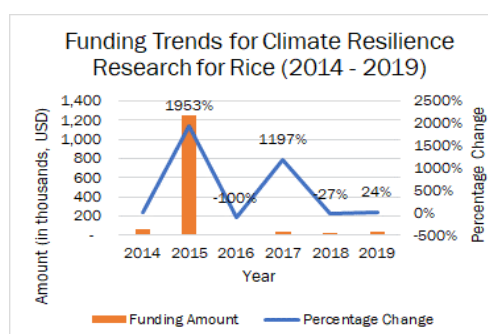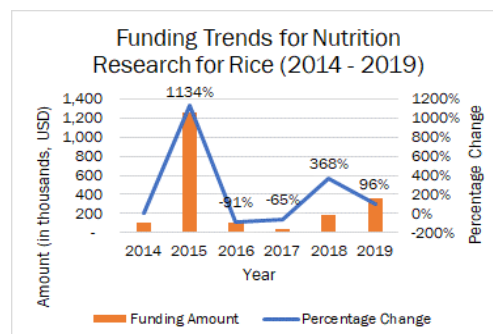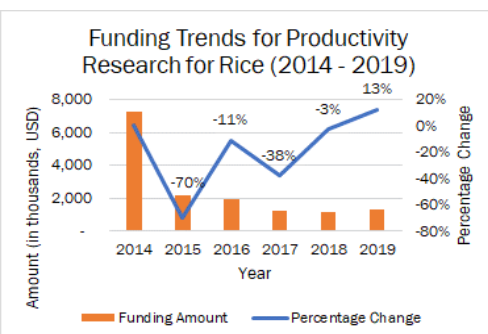
Figure 11 - Funding Trends for Rice Research by Impact Areas

As shown in the table above, agricultural research for rice has consistently cut across all the four impact areas of focus across the six years, although with varying funding contributions. Productivity was the impact area that received the highest funding for research across all the years and in total. Sustainability was the second-highest funded impact area in total, followed by nutrition, while climate resilience was the least funded research area across the years. However, the annual funding trends for rice revealed a decrease of over 100% between 2014 and 2019, compared to the total funding received in 2014. While funding contribution from the FGN varied across the years, the decrease in annual funding trends is more evident in the contribution from donors which may imply changes in the priority focus of donors as it relates to rice research in recent years.

Box 6: Maize - Funding Trends by Funding Source and Across Impact Areas

The table below details the estimated amount spent by the research institutes responsible for maize research in Nigeria, across the impact areas of productivity, nutrition, climate resilience, and sustainability while the charts below show the funding trends by impact areas across 2014 and 2019.

Table 8 - Funding Trends for Agricultural Research on Maize by Source and Impact Areas

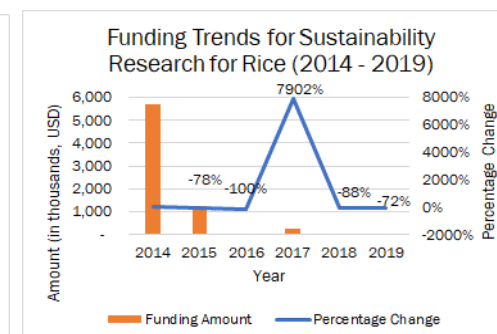| Funding Trends for Agricultural Research on Maize by Funding Source and Impact Areas (in '000, USD)																			Total
	2014			2015			2016			2017			2018			2019			
	FGN	Donors	Priv Sec.	FGN	Donors	Priv Sec.	FGN	Donors	Priv Sec.	FGN	Donors	Priv Sec.	FGN	Donors	Priv Sec.	FGN	Donors	Priv Sec.	
Productivity	120	585	278	108	692	473	24	588	515	8	576	520	44	540	46	25	716	77	5,935
Sustainability	4	648	-	1	388	-	18	373	-	8	335	-	37	331	-	15	371	-	2,529
Climate Resilience	13	877	-	1	446	-	24	44	-	8	13	-	37	37	-	15	68	-	1,584
Nutrition	21	52	-	1	28	-	10	136	-	8	109	-	13	133	-	9	220	-	739
Others	-	30	-	5	25	-	5	4	-	-	5	-	-	4	-	-	63	-	142
Total	157	2,193	278	116	1,579	473	81	1,145	515	30	1,037	520	133	1,045	46	64	1,438	77	10,928
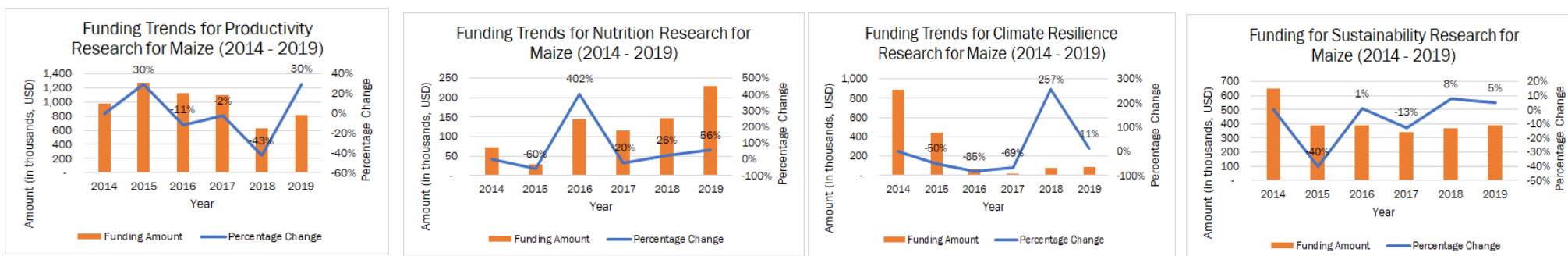
Figure 12 - Funding Trends for Maize Research by Impact Areas

Across the six years, the analysis of data trends showed that all four impact areas consistently received funding for research, from different funding sources. While the FGN and donor and development organizations consistently provided funding for maize research across all four impact areas, funding from the private sector only focused on improving the productivity of the crop. Productivity consistently received the highest funding commitment in each of the years and about 54% of the total estimated funding for maize research across the six years. This is followed by the impact areas of sustainability at 23%, climate resilience at 14%, and nutrition at 6% of the total estimated funding for maize research between 2014 and 2019.

In further comparison across the two crops in the cereal category, Sahel analysed the average funding spent on rice and maize across the impact areas between 2014 and 2019. The chart below shows the average funding for rice and maize across the impact areas:
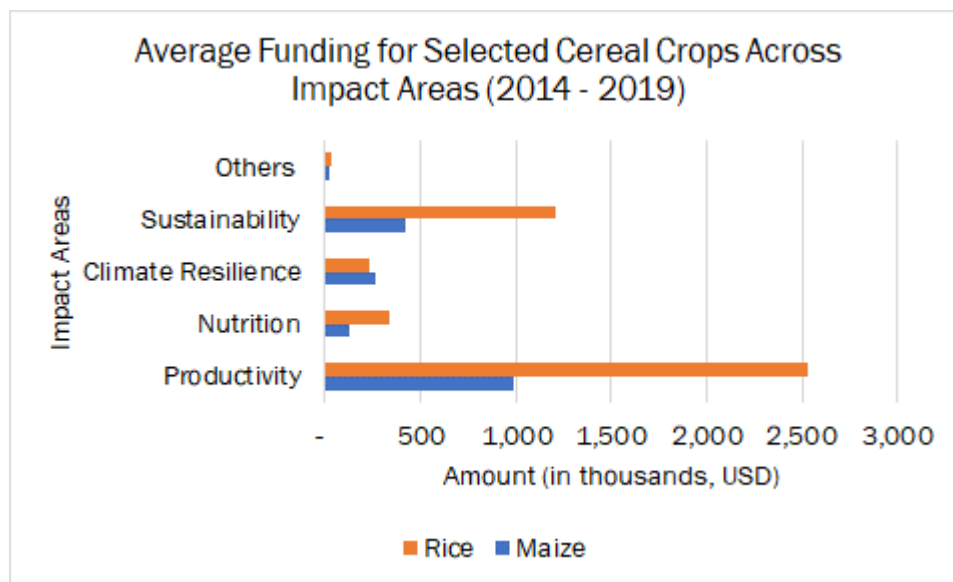
Figure 13 - Average Funding for Selected Cereal Crops Across Impact Areas

Between 2014 and 2019, rice received the most funding for research compared to maize. Rice also received the most funding for research across three of the impact areas, except climate resilience, in which maize received more funding. The similarity between both crops is evident in the impact areas of productivity and sustainability, which are the two major impact areas of focus for both crops, as revealed by funding trends from the research institutes between 2014 and 2019.

Legumes

Sahel analysed the data received from NCRI, the NARI with the national mandate for soybean development in Nigeria, IAR, the additional NARI that worked on soybean research projects, and IITA to identify spending trends for the crop in Nigeria across the focus impact areas.

The table below details the estimated amount spent on soybean in Nigeria across the impact areas of productivity, nutrition, climate resilience, and sustainability while the charts below show the funding trends by impact areas across 2014 and 2019.

Table 9 - Funding Trends for Agricultural Research on Soybean by Source and Impact Areas

Funding Trends for Agricultural Research on Soybean by Funding Source and Impact Areas (in '000, USD)																			Total
	2014			2015			2016			2017			2018			2019			
	FGN	Donors	Priv Sec.	FGN	Donors	Priv Sec.	FGN	Donors	Priv Sec.	FGN	Donors	Priv Sec.	FGN	Donors	Priv Sec.	FGN	Donors	Priv Sec.	
Productivity	138	811	-	113	213	-	3	210	-	31	234	-	39	132	-	4	266	-	2,194
Sustainability	-	87	-	-	91	-	-	88	-	31	82	-	39	82	-	1	85	-	587
Nutrition	39	5	-	6	9	-	-	5	-	31	-	-	18	0.1	-	4	134	-	251
Climate Resilience	9	5	-	-	9	-	-	6	-	31	0.4	-	39	0.1	-	1	6	-	107
Others	11	-	-	4	-	-	5	5	-	46	0.1	-	59	0.1	-	2	6	-	139
Total	197	907	-	123	323	-	8	314	-	168	317	-	196	215	-	12	497	-	3,277
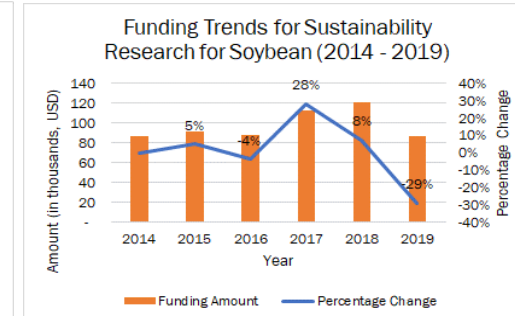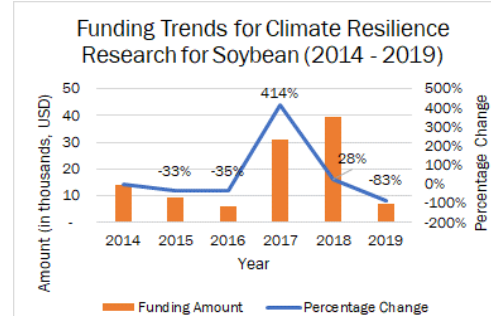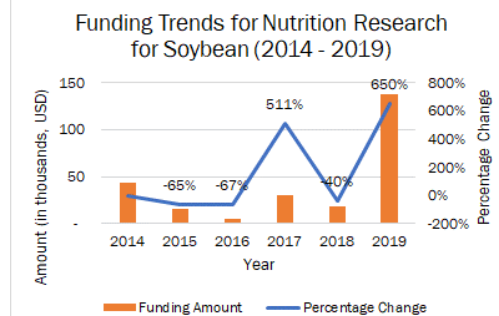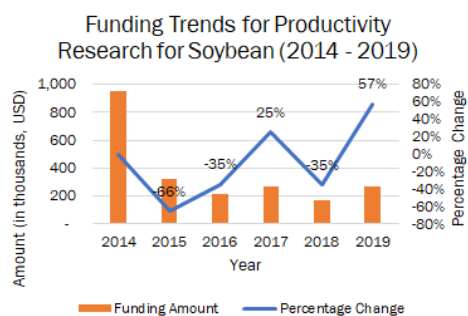
Figure 14 - Funding Trends for Soybean Research by Impact Areas

As shown in the table above, productivity consistently received more funding from 2014 to 2019, compared to the other focus impact areas of nutrition, climate resilience, and sustainability. Sustainability research is the second most funded impact areas and consistently received funding between 2014 – 2019, followed by funding to enhance the nutritional value and climate resilience of the crop. In terms of funding commitment from the various sources for soybean research, only the FGN and donor organizations provided funding for research for the crop as staed by the research institutes, with no record of funding received from private sector organizations between 2014 and 2019.

Box 8: Fruits and Vegetables - Funding Trends by Funding Source and Across Impact Areas

Sahel analysed the data received from NIHORT, the NARI with the national mandate for fruits and vegetables in Nigeria, to identify spending trends for the crop category in Nigeria across the focus impact areas. The table below details the estimated amount spent on research on fruits and vegetables in Nigeria across the impact areas of productivity, nutrition, climate resilience, and sustainability while the charts below show the funding trends by impact areas across 2014 and 2019.

Table 10 - Funding Trends for Agricultural Research on Fruits and Vegetables by Source and Impact Areas

Funding Trends for Agricultural Research on Fruits and Vegetables by Funding Source and Impact Areas (in '000, USD)																		Total
	2014			2015			2016			2017			2018			2019			
	FGN	Donors	Priv Sec.	FGN	Donors	Priv Sec.	FGN	Donors	Priv Sec.	FGN	Donors	Priv Sec.	FGN	Donors	Priv Sec.	FGN	Donors	Priv Sec.	
Productivity	182	-	-	96	-	-	396	-	-	833	20	3	1,155	32	-	386	29	-	3,132
Nutrition	182	-	-	96	-	-	396	-	-	833	20	3	1,155	32	-	386	29	-	3,132
Climate Resilience	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sustainability	26	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	26
Total	390	-	-	192	-	-	793	-	-	1,667	40	6	2,310	65	-	771	57	-	6,290
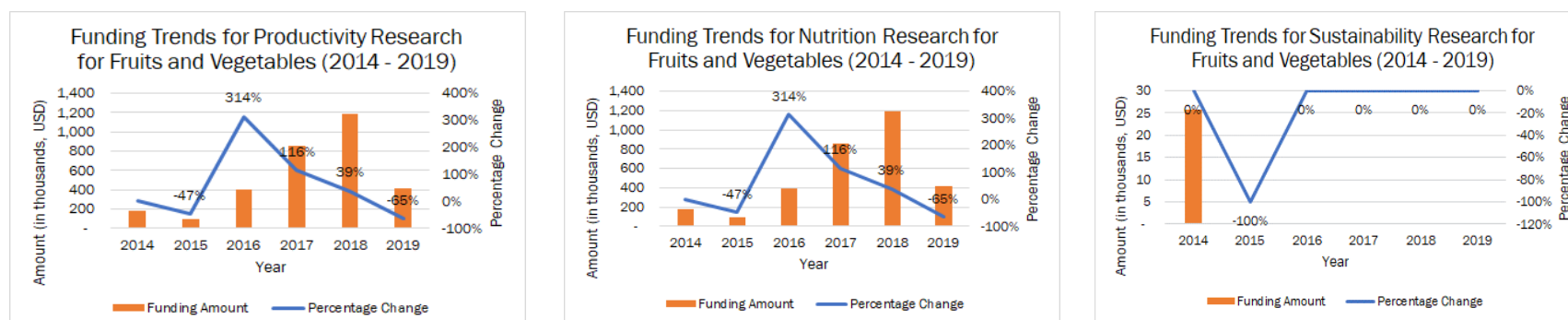
Figure 15 - Funding Trends for Fruits and Vegetables Research by Impact Areas

The funding trends for fruits and vegetables reveal that research funding for the category has historically been provided solely by the FGN until 2017 with contributions from donor and development organizations and the private sector. Although the analysis reveals equal funding commitment across the funding sources on the impact areas of productivity and nutrition, this may not reflect an accurate picture, given the assumption of the equal split of funding across the impact areas when multiple impact areas are recorded for projects, as defined by the research institute.

The impact areas of sustainability and climate resilience consistently received no funding from any of the funding sources, except in 2014 when a total of 26,000 USD from the FGN was spent on sustainability research, implying minimal focus of research across these areas.

Aquaculture

Sahel analysed the data received from NIFFR, the NARI with the national mandate for freshwater fisheries in Nigeria, to identify spending trends in Nigeria across the focus impact areas.

Box 9: Freshwater Fisheries - Funding Trends by Funding Source and Across Impact Areas

The table below details the estimated amount spent on freshwater fisheries in Nigeria across the impact areas of productivity, nutrition, climate resilience, and sustainability while the charts below show the funding trends by impact areas across 2014 and 2019.

Table 11 - Funding Trends for Agricultural Research on Freshwater Fisheries by Source and Impact Areas

Funding Trends for Agricultural Research on Freshwater Fisheries by Funding Source and Impact Areas (in '000, USD)																			Total
	2014			2015			2016			2017			2018			2019			
	FGN	Donors	Priv Sec.	FGN	Donors	Priv Sec.	FGN	Donors	Priv Sec.	FGN	Donors	Priv Sec.	FGN	Donors	Priv Sec.	FGN	Donors	Priv Sec.	
Productivity	116	-	-	82	-	-	524	-	-	426	-	-	408	-	-	31	-	-	1,587
Sustainability	5	-	-	5	-	-	69	-	-	1,061	-	-	1,018	-	-	137	-	-	2,295
Nutrition	-	-	-	5	-	-	-	-	-	301	-	-	218	-	-	11	-	-	536
Climate Resilience	-	-	-	-	-	-	-	-	-	31	-	-	34	-	-	-	-	-	65
Others	58	-	-	31	-	-	-	-	-	805	-	-	705	-	-	111	-	-	1,710
Total	179	-	-	123	-	-	593	-	-	2,624	-	-	2,383	-	-	289	-	-	6,191
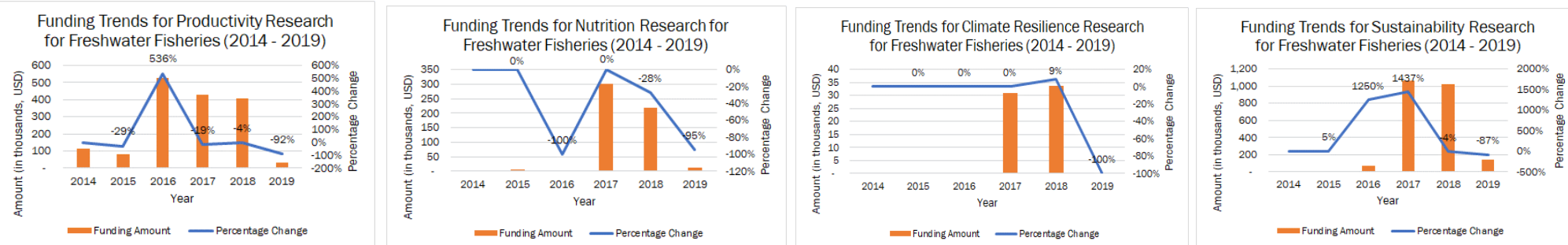
Figure 16 - Funding Trends for Freshwater Fisheries Research by Impact Areas

The funding trends for freshwater fisheries research reveal consistent funding across the years for the impact areas of productivity and sustainability. However, the impact area of sustainability received the highest funding contribution, followed by the impact areas of productivity and nutrition. The data analysis shows that climate resilience research relating to freshwater fisheries is minimal and poorly funded. It is also important to note that between 2014 and 2019, the FGN was the only source of funding for research on freshwater fisheries in Nigeria, implying that the commodity is not a priority area for donors and the private sector.

Comparison Across Crop and Commodity Categories

The table below compares the total estimated funding received by the research institutes analysed in this report, between 2014 to 2019, across the impact areas of focus and the crops and commodity areas analysed in this chapter.

Table 12 - Total Estimated Funding for Crops and Commodities Across Impact Areas Between 2014 - 2019

Total Funding for Crops and Commodities Across Impact Areas Between 2014 – 2019 (in thousands, USD)								
Categories	**Root and Tubers**		**Cereals**		**Legumes**	**Fruits and Veg.**	**Aquaculture**	
Crops/Commodities	**Cassava**	**Yam**	**Rice**	**Maize**	**Soybean**	**Fruits and Veg.**	**Fisheries**	**Total**
Productivity	26,552	7,891	15,164	5,935	2,194	3,132	1,587	62,455
Sustainability	4,016	2,605	7,235	2,529	587	26	2,295	19,292
Nutrition	8,572	1,997	2,038	739	251	3,132	536	17,265
Climate Resilience	170	123	1,419	1,584	107	-	65	3,467
Others	323	13	211	142	139	-	1,710	2,537
Total	39,633	12,629	26,068	10,928	3,277	6,290	6,191	105,016

Overall, across the focus commodity categories, the root and tuber category received the highest cumulative funding for agricultural research in Nigeria, for about 52 million USD, with cassava receiving over 75% of the funding under the category. Compared to other crops, only cassava received funding higher than the total amounts received under each of the other categories. Cereal is the second-highest funded category at 36.9 million USD, with rice receiving 70% of the funding for the category between 2014 and 2019. Fruits and vegetables are the third-highest funded category at 6.2 million USD, closely followed by fisheries at 6.1 million USD. Legumes received the lowest funding across all categories between 2014 and 2019, at 3.2 million USD, represented by the soybean crop.

Based on the analysis of data received from the NARIs and CGIAR centres as shown in the table above, funding commitment for agricultural research in Nigeria across the selected categories has been largely focused on the impact area of productivity, which received over 59% of the total funding commitment between 2014 and 2019. This is followed by sustainability at 18%, nutrition at 16%, and climate resilience at 3% of the total estimated funding received by the institutes between 2014 and 2019.

Chapter Summary

Agricultural Research Funding Trends

- There are three (3) major funders of agricultural research in Nigeria, the FGN, donor and development organizations and private sector organizations.
- The FGN is the largest funder of the NARIs and appropriates funding based on the institutes' annual budgets; however, annual disbursements to the NARIs are often lower than the amounts appropriated. Donor and development organizations are the second major funding source of the NARIs, followed by funding from the private sector, which included funding for both public and private agricultural research conducted by the institutes.
- International institutes such as IITA receive most of their funding from donor and development organizations, followed by private sector organizations and the Nigerian

government. Between 2014 and 2019, donor organizations provided over 85% of the funding received by IITA for projects in Nigeria.

Agricultural Research Funding Trends across Focus Impact Areas

- Funding trends for the focus impact areas of productivity, nutrition, climate resilience and sustainability were analysed across the categories of root and tubers, represented by cassava and yam; cereals, represented by rice and maize; legumes, represented by soybean; fruits and vegetables; and fisheries.
- Across the categories, root and tubers received the highest cumulative funding for agricultural research in Nigeria, with cassava receiving over 75% of funding for the category. Cereal received the second-highest funding, with rice receiving 70% of the funding for the category. Fruits and vegetables are the third-highest funded category, followed by fisheries and legumes, respectively.
- Funding commitment for agricultural research in Nigeria across the categories has been largely focused on productivity, which received over 59% of the total estimated funding commitment from all sources between 2014 and 2019. This is followed by research on sustainability at 18%, nutrition at 16%, and climate resilience at 3% of the total estimated funding for research between 2014 and 2019.

PUBLIC AGRICULTURAL RESEARCH ON NUTRITION, FOOD PRODUCTIVITY, CLIMATE RESILIENCE, AND SUSTAINABILITY AND ITS IMPACT ON END-USERS

This chapter will discuss the impact of agricultural research on end-users across select crops as analysed in the previous chapter. It will provide the current status of the focus impact areas in Nigeria in terms of food and nutrition security, productivity improvement, and environmental sustainability. It will also discuss the contribution of public agricultural research to these focus areas across select crops and its impact on end-users. It will highlight the extent to which the funding focus across these areas has impacted the status of productivity, nutrition, and environmental sustainability of the country and end-users over the past six years. Finally, it will highlight the factors that influence the expected impact of public agricultural research across the focus impact areas.

Context of Nutrition, Food Productivity, Climate Resilience and Sustainability in Nigeria

Nutrition: According to the 2018 Nigeria Demographic and Health Survey (NDHS), 37% of children under five (5) in Nigeria are stunted, with 17% severely stunted, down from 41% and 23%, respectively, in 2008. However, the chart below shows the percentage of stunting in children under five (5) was stagnant between 2013 and 2018.

Percentage Prevalence of Stunting in Children Under 5 in Nigeria (1990-2018)

1990	1999	2003	2008	2013	2018
48.70	45.50	42.40	40.60	36.80	36.80
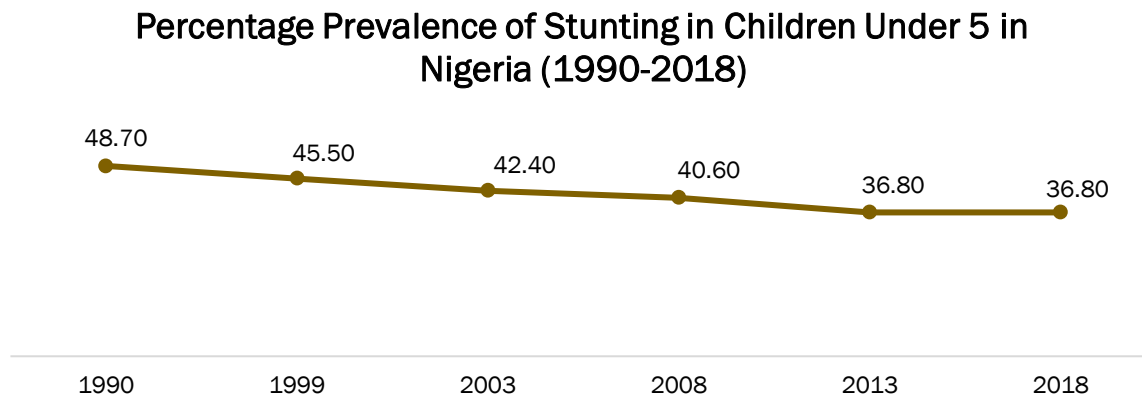
Figure 17 - Percentage Prevalence of Stunting in Children Under 5 in Nigeria (1990 - 2018)

Source: Nigeria Demographic and Health Survey (NDHS) Through the Multi-Source Data Analytics & Triangulation (MSDAT) Platform, Federal Ministry of Health, Nigeria

There is also a high prevalence of micronutrient deficiency in Nigeria, 68% of children are anaemic, and 58% of women ages 15 – 49 have some degree of anaemia, of which the majority are in rural areas (NDHS, 2018). About 29% of children under five (5) in Nigeria also suffer from vitamin A deficiency (Agricultural Sector Food Security and Nutrition Strategy, 2016). According to the Agricultural Sector Food Security and Nutrition Strategy (AFSNS) (2016 – 2025) of the Federal Government of Nigeria (FGN), biofortification is a priority initiative to improve the micronutrient status in the country, and the government aims to scale up the development of the bio-fortified crops already introduced in Nigeria. These include pro-vitamin A cassava, maize, orange-fleshed

sweet potato, and biofortified iron-rich sorghum. The strategy also identified the promotion of nutrition research to produce crop varieties with increased nutrients to improve the country's nutritional status (AFSNS, 2016). Also, the FGN mandates the fortification of key staples with micronutrients such as vitamin A in wheat and maize flour, sugar and vegetable oils, iron in wheat and maize flour, and iodine in salt.

Food Productivity: In terms of food production, Nigeria currently does not produce enough food to meet its increasing population demand. Nigeria still relies on imports to fill supply gaps across major staple crops which the country can grow, such as maize and rice. Across various crops in the country, yields on farmer fields are low compared to global best practices. For instance, the World Bank (2017) puts the average cereal yield in Nigeria at 1.4 MT/ha, which is low compared to the global average of 4MT/ha.

Environmental Sustainability: The effects of climate change, such as unpredictable and extreme weather conditions, also continue to pressure the existing arable land and water resources in Nigeria. According to the Nigeria National Adaptation Plan Framework 2020, the lack of climate adaptation strategies could result in a loss of between 6% and 30% of the national Gross Domestic Product (GDP) by 2050. The effects of climate change are evident across the country, at varying levels. For instance, the frequency of droughts and desertification in Northern Nigeria limits access to grazing lands. It often leads to the migration of herders and their cattle further south of the country, leading to clashes between farmers and herders. Heat and drought stresses on crops, particularly in the Northern region and flooding in several parts of the country contribute to crop yield losses.

Impact of Public Agricultural Research on Crop Improvement

This section will focus on five major crops in Nigeria, cassava, yam, maize, rice, and soybean – across the root and tuber, cereal, and legume crop categories, to highlight the impact of research across the focus impact areas on end-users.

Root and Tubers

A. Cassava

Forty-six (46) varieties of cassava have been developed by NRCRI and IITA and released in Nigeria, with fifteen (15) of the varieties released in the last ten (10) years. The table in [Appendix X] details the cassava varieties released in 2009 and their characteristics.

As detailed in the previous chapter, funding trends reveal that most funding for cassava between 2014 and 2019 was dedicated to productivity, accounting for about 66% of the total estimated funding for the crop, followed by nutrition at 21%. The four (4) researchers interviewed at the NRCRI also indicated that cassava research has mainly focused on improving the yield potential, nutritional value, and processing qualities such as high starch and dry matter content. This research focus aligns with the major attributes that end-users such as farmers and processors seek in cassava. Six (6) of the 15 varieties of cassava released in Nigeria since 2009 are biofortified with vitamin A.

Sahel's interviews with research institutes and end-users revealed that the most widely adopted cassava variety is TMEB 419 due to its high starch and dry matter content and erect stems. These

attributes make it suitable for industrial processing and seed production. Despite its introduction in 2005, TMEB 419 is still in high demand over recently released varieties. However, some other varieties such as IBA961632 (*Farmer's Pride*), IBA980581 (*Dixon*), CR 36-5 (*Ayaya*), IBA070693 (*Sunshine*), IBA980505 (*Fine Face*) were recently released to complement TMEB 419. Other varieties in the registration release pipeline include TMS13F1160P0004 (*Game Changer*), TMS13F1343P0022 (*Obasanjo-2*), NR130124 (*Hope*) and TMEB693 (*Poundable*), which according to the researchers, have the potential to address the needs of the markets.

Based on insights from interviews, despite research efforts on cassava bio-fortification, adoption of biofortified varieties, which have yellow roots, is relatively low due to the preference for white roots in food processing. Also, bio-fortified varieties are not suitable for large-scale industrial processing due to low dry matter contents, recording low demand from processors compared to the other varieties.

Based on Sahel's engagement with cassava processors under the Building an Economically Sustainable Cassava Seed System Phase II (BASICS-II) project, large scale industrial cassava processors have concerns over the quality of cassava varieties available in Nigeria. Industrial processors are interested in cassava varieties that yield 30-40MT/ha and produce an average starch content of 22% all year-round. For instance, an industrial cassava processor noted five months of the year when the starch level of available cassava varieties is below 15% and two critical months when it is less than 10%. During these months, processors have an idle capacity which affects cashflows.

The chart below shows the trends in cassava production and yield in Nigeria from 2009 to 2018.[14]
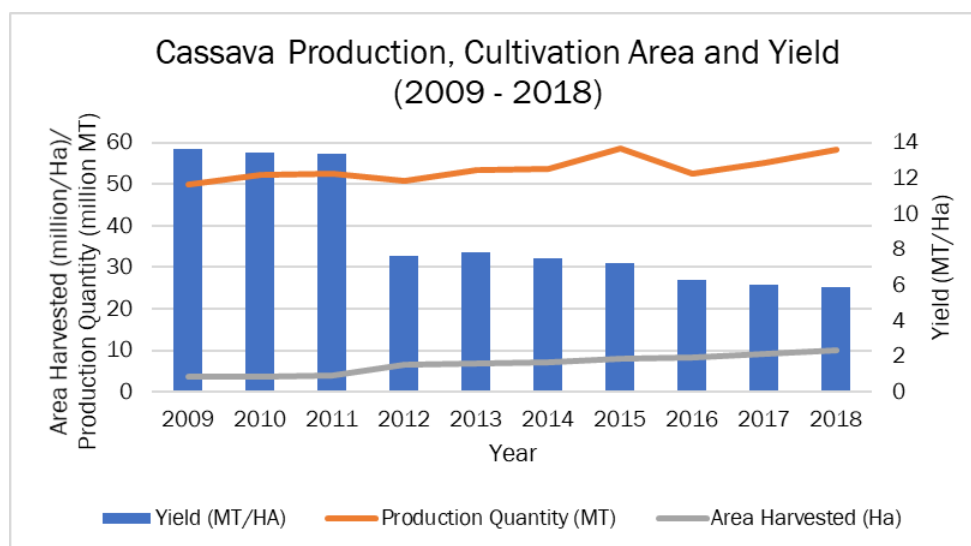
Source: The Agricultural Performance Surveys, NAERLS (2009 – 2018)

Figure 18 - Cassava Production and Yield in Nigeria (2009 - 2018)

As shown in the figure above and as corroborated by Oluwafemi, Z.O. et al. (2019), while the production quantity of cassava in Nigeria increases, the increase can be attributed to a consistent increase in the cultivated area for cassava, rather than an increase in yield. Cassava yields have dropped consistently since 2009 and average 8.89 MT/ha across the years, compared to the yield

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[14] The sudden drop in cassava yield trends between 2011 and 2012 may be attributed to the quality of the available data.

potential of improved varieties developed in Nigeria, ranging from 29.4 to 59.9MT/ha as stated by researchers. It is important to mention that farmers have achieved cassava yields of 9 - 15MT/ha in some states in Nigeria, such as Benue, Kogi, Ondo, Imo, and Rivers, with each producing over 3 million MT (APS, 2019). Some of these states, such as Benue, Kogi and Imo, have also been the major focus of donor-funded programmes such as BASICS, which promotes the adoption of improved varieties and supports the accessibility of improved stems to farmers. Based on Sahel's engagement on the BASICS projects, most leading cassava processors in Nigeria have also achieved a yield of more than 15MT/ha.

B. Yam

Twenty-one (21) varieties of yam have been developed and released, and ten (10) since 2009. The table in Appendix XI details the varieties of yam released since 2009 and their characteristics. Based on the characteristics of these varieties, the focus of yam research has been on increased productivity and resistance to pests and diseases. This research focus is also evident in the funding trends for yam research between 2014 and 2019 as productivity accounted for over 62% of yam's total funding within this period.

The figure below shows the trends in yam production and yield in Nigeria from 2009 to 2018:
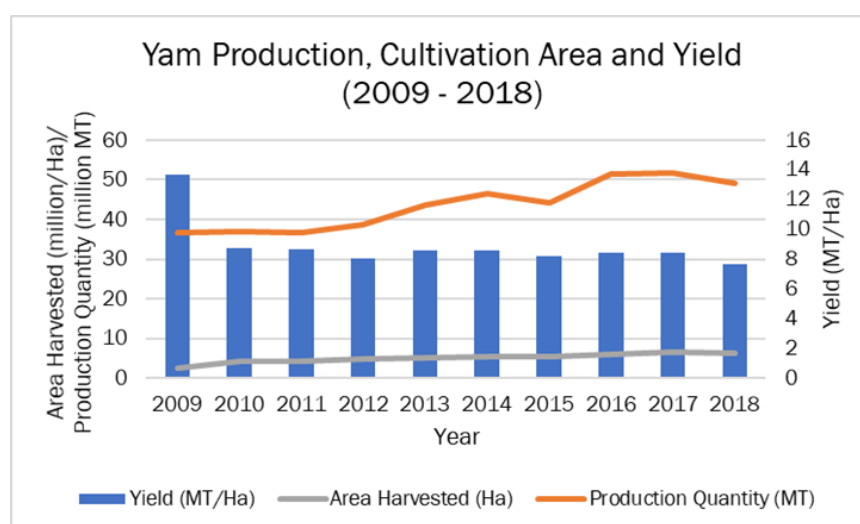
Figure 19 - Yam Production and Yield in Nigeria (2009 - 2018)

Source: The Agricultural Performance Surveys, NAERLS (2009 – 2018)

The trends in the production and yield of yam in Nigeria mirror trends in cassava production and yield. Like cassava, while the production quantity of yam in Nigeria has increased since 2009, this can be attributed to an increase in the crop's cultivated area, not increases in yields. From 2010, there has been minimal growth in the crop yield, which has averaged 8MT/ha.

Based on Sahel's engagement on the Yam Improvement for Incomes and Food Security in West Africa Phase II (YIIFSWA-II) project, yam farmers in Nigeria still prefer to plant old landraces with high disease susceptibility and lower yield potential compared to the newer varieties. However, according to a seed system expert within IITA, the YIIFSWA-II project is promoting the adoption of three (3) improved varieties – TDr 89/02665 (*Asiedu*), TDr 95/19177 (*Kpamyo*), and TDa 98/01176 (*Swaswa*). Nevertheless, the adoption of these newer yam varieties is still low among

farmers. One of the major reasons for the low adoption of new varieties is the failure to demonstrate significant improvement in customer desired qualities such as taste, size, shape, and colour of yam tubers.

Cereals

A. Rice

Seventy-three (73) rice varieties have been developed and released in Nigeria. Since 2009, twenty (20) rice varieties have been released, and Appendix XIII details the rice varieties and their characteristics. According to data from the research institutes, between 2014 and 2019, productivity research accounted for 58% of the funding received for rice.

Based on the characteristics of rice varieties released in Nigeria, the focus of rice research has been on yield enhancement and ensuring the resistance of varieties to abiotic stresses such as lodging and drought. Although there has been research on rice hybrids, research efforts are still in the preliminary stages. According to Sahel's field research, in 2014, the Africa Rice Centre partnered with NCRI to develop rice hybrids and conducted demonstrational trials to test the hybrids. However, the hybrids generated similar yields to the existing rice varieties in Nigeria and did not qualify for release by the National Varietal Release Committee. There are currently no rice hybrids developed by public agricultural research and released for commercialization in Nigeria.

Interviews with respondents from three (3) indigenous private seed companies revealed that the most adopted variety by their customers is FARO 44, a lowland long-grain rice variety released in 1990 by IITA, IAR, and the Africa Rice Centre. According to the respondents, the high adoption of FARO 44 is driven by demand from integrated rice processing mills. Although released in 1990, the FARO 44 variety is still in high demand due to consumers' preference for long-grain rice. The adoption of other long-grain varieties developed after FARO 44, as revealed by interview respondents, is still low due to poor technological transfer from researchers to end-users.

The figure below shows trends in rice production and yield in Nigeria from 2009 to 2018.

Figure 20 - Rice Production and Yield in Nigeria (2009 - 2018)
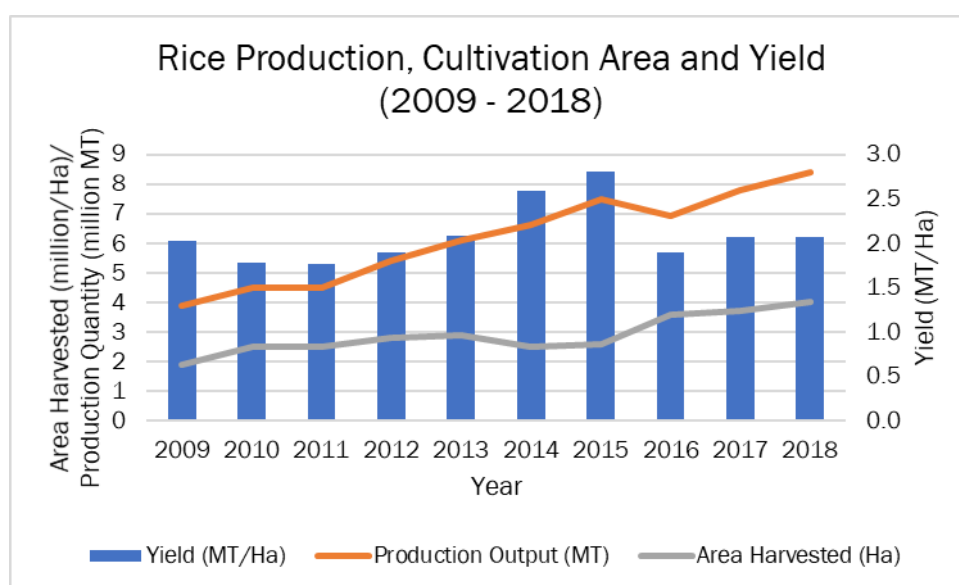
Between 2010 and 2015, rice yields consistently increased, which may point to the positive impact of research for varieties with high yield potential and its adoption by end-users. However, the increase in yield during this period may also be due to the government's support of local rice processing, which led to the emergence of commercial mills and unlocked opportunities for private sector companies to collaborate with farmers for rice paddy production. During this period, the FGN also introduced a dry season farming initiative across the leading rice-producing states in Northern Nigeria under the Growth Enhancement Support (GES) Scheme and subsidized seed and fertilizer prices for farmers from 2012 to 2015 to support rice farmers to access improved inputs for production. The sudden decrease in yields between 2015 and 2016 may be attributed to the end of the GES scheme, as farmers may have reverted to the use of recycled seeds and substandard in subsequent years. However, the increase in rice production quantity from 2016 can be attributed to the increasing cultivated area and current interventions of the FGN through policies to spur domestic production and reduce the reliance on imports.

B. Maize

A hundred and forty-six maize (146) varieties, including Open Pollinated Varieties (OPVs) and hybrids, have been developed by IAR, IAR&T, and IITA and released in Nigeria, and eighty-two (82) maize varieties developed from 2009 till date.[15] The table in Appendix XII details the maize varieties developed since 2009 and their characteristics. Since 2014, the research focus for maize, as evident in the funding commitment, has consistently cut across all focus impact areas, with productivity accounting for 54% of the funding received, followed by sustainability and climate resilience at 23% and 14%, respectively. The key characteristics of the released varieties include high yield potential, increased nutritional content, early maturity, and tolerance to drought, low soil fertility, heat, and diseases and pests such as the *Striga hermonthica – a* parasitic weed.

Sahel's interviews with two (2) senior breeders and researchers within IAR and IAR&T, the two (2) NARIs with the national mandate for the genetic improvement of maize, corroborated findings from the data analysis that research for maize has majorly focused on improving crop productivity over the years. According to the breeders and the data from the NARIs, research has also focused on improving the crop's ability to withstand harsh environmental conditions and sustainability research. Although maize research has also focused on increasing its nutritional content, this area has received the least funding between 2014 and 2019. Nevertheless, seven (7) of the maize varieties in Nigeria released between 2012 and 2016 by IITA, IAR and IAR&T are pro-vitamin A maize varieties and rich in beta-carotene. These seven (7) varieties and a wide range of other maize varieties released in Nigeria are tolerant to drought, diseases, and pests. As stated by the breeders, research for maize continues to cut across multiple areas of impact, and it is almost impossible to separate research for productivity from climate resilience and sustainability as the latter also contributes to the crop's productivity.

The figure below shows trends in maize production and yield in Nigeria from 2009 to 2018.

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[15] In addition to the varieties developed using funding allocation to the NARIs from the federal government, some varieties were also developed and released through funding support from donor and development organizations and private sector organizations. Some of these varieties are privately bred varieties, exclusively owned by multinational seed companies but available for sale in Nigeria.

Figure 21 - Maize Production and Yield in Nigeria (2009 - 2018)

Source: The Agricultural Performance Surveys, NAERLS (2009 – 2018)

Despite the research efforts on maize across all impact areas, the yield in Nigeria is low and has remained below 2MT/ha in the last ten (10) years. Although the yield is still below global best practices, there has been an increasing trend in yield and production quantity since 2015. This trend may be due to the growing adoption of improved maize varieties by end-users.

It is noteworthy that despite the marginal increase in yield in the last four years, maize production in Nigeria is still insufficient to meet the local demand as the country relies on imports to bridge the supply shortfall. In 2018, Nigeria imported an estimated 550,000MT of maize to cover part of the supply shortfall. (Sahel research, 2018)

Legumes

A. Soybean

Twenty-three (23) soybean varieties have been released in Nigeria and only six (6) since 2009. The table in Appendix XIV details the soybean varieties developed since 2009 and their characteristics. According to Sahel's interview with a senior soybean breeder at NCRI, soybean research has largely focused on productivity, with some research to improve the climate resilience of the crop. According to the respondent, between 2008 and 2010, under the Tropical Legumes I & II programme funded by the BMGF, research focused on developing high yielding varieties, including high fodder yield, rust-resistant and drought-tolerant varieties. Since 2014, soybean research has retained a major focus on productivity in breeding for yield improvement and early maturity of the crop.

According to Sahel's interviews, the most adopted soybean variety by farmers in Nigeria is the TGX 1448-2E, a variety developed in 1992 and resistant to shattering, a preferred quality by farmers. Despite the introduction of improved varieties such as the TGX 1904-6F developed in 2008, with characteristics such as tolerance to *Striga hermonthica*, resistance to shattering, and environmental stresses such as lodging, the adoption rate among farmers is still lower compared to TGX 1448-2E.

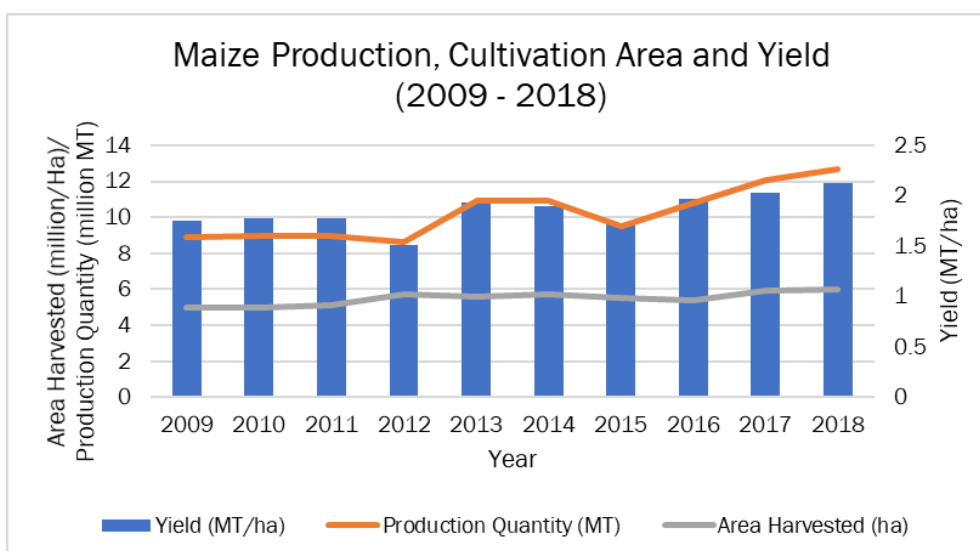The figure below shows trends in soybean production and yield in Nigeria from 2009 to 2018.
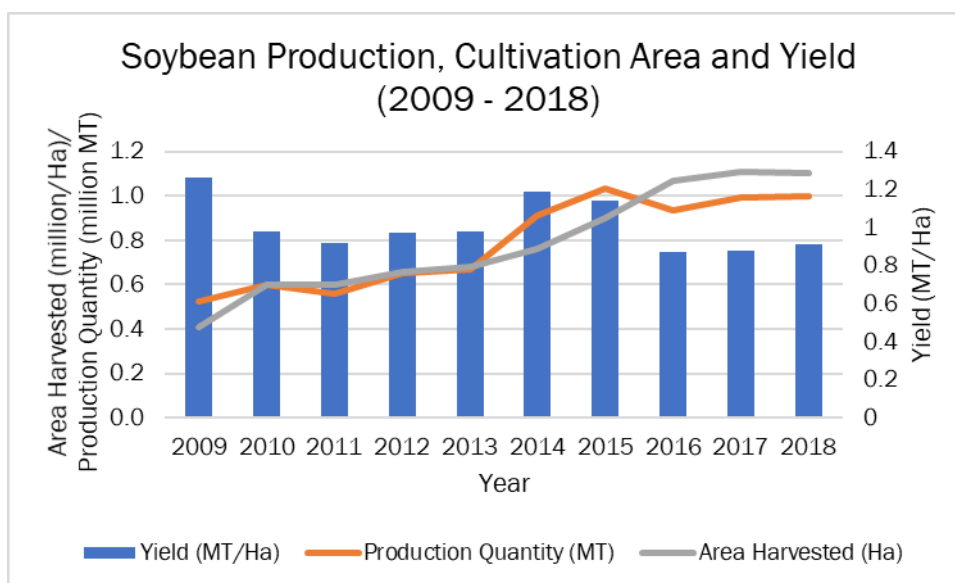
Figure 22 - Soybean Production and Yield in Nigeria (2009 - 2018)

Source: The Agricultural Performance Surveys, NAERLS (2009 – 2018)

Across the years, the yield for soybean has been low, averaging 1MT/ha, except for increases in a few years. The yield for soybean has also consistently remained below 1MT/ha since 2016, despite increases in the crop area under cultivation.

Summary of Impact of Research on End-Users Across Crop Categories

As corroborated by the funding data received from the NARIs, research on productivity represents the largest research focus of the research institutes, for each of the crops. However, trends in the productivity of the crops, as detailed in the Agricultural Performance Surveys of NAERLS, reveal that yield of all five (5) crops have only slightly increased or even decreased within the timeframe of focus, implying minimal impact on end-users. For example, the yields of rice and maize have slightly increased as shown in Figures 20 and 21, while yields of cassava, yam and soybean have decreased over time, as shown in Figures 18, 19 and 22, respectively.

Cumulatively, sustainability is the second-largest focus of research based on funding received across the crops between 2014 and 2019, although cassava records sustainability as its third-highest funded impact area. Despite the effect of enhancing the sustainability of the crops on improving crop yields, yields on farmer fields remain low, compared to the yield potential stated by the NARIs.

Nutrition is the third impact area that has received the most funding for research based on the funding analysis, except for cassava and maize. While nutrition is the second-highest funded research area for cassava, representing over 63% of the total funding received for nutrition across the selected crops, it is the least funded impact area for maize. However, despite research for the bio-fortification of crops in Nigeria, such as cassava and maize, two (2) of the four (4) bio-fortified crops in Nigeria, the country's nutritional status as detailed earlier in the chapter has remained stagnant between 2013 and 2018.

Historically, climate resilience has received the lowest funding for research in general, across all the crops except maize which has received significant focus in this area evident in funding commitment and the characteristics of maize varieties released in the country. Compared to the other impact areas, the low funding focus on climate resilience for the other crops could imply that research on the impact area has not been a priority focus area or has been minimal. The limited research on this impact area could also be related to the low crop productivity recorded, as adverse weather conditions due to climate change negatively impacts the productivity of crops on fields.

While the minimal changes in the country's crop productivity and nutrition status may imply the minimal impact of research on end-users, it is important to note that additional factors, asides from funding for or the quality of research conducted, also influence the impact of research on end-users.

Factors that Influence the Impact of Public Agricultural Research Across Crops

In addition to research efforts on the selected crops across the focus impact areas, additional factors also influence the impact of research on end-users. Based on an aggregate of responses from stakeholder interviews, these factors range from the low adoption of improved varieties to limited access to quality planting materials, poor agronomic practices, and socio-economic factors such as conflicts, high cost of inputs, and poor agricultural financing.

A.   Low Adoption of Improved Varieties

Maize: Sahel's interview with three (3) indigenous private seed companies further revealed low adoption of improved seeds, especially hybrids, among farmers. These seed companies stated the reluctance of their customers to produce maize hybrids, citing low returns on investment from the crop yields as a major reason for this reluctance, especially given the high cost of hybrid production due to the high requirement of inputs. According to respondents at the seed companies, some farmers report attaining comparable yields between the maize hybrids and improved OPVs, even with a higher cost of production of hybrids.

Additionally, only a few indigenous private seed companies have adopted hybrids as part of their maize product portfolio. According to Sahel's research and interviews with seed companies, less than 5% of indigenous seed companies produced maize hybrid seed in 2019 of over 300 seed companies in Nigeria. A researcher at one of the NARIs with the national research for maize further stated that most indigenous private seed companies in Nigeria possess limited technical capacity and expertise to produce maize hybrid commercial seed from the parental seed received from the research institutes. As such, poorly produced certified maize hybrids by seed companies contributes to low yields attained by farmers, leading to their unwillingness to adapt hybrids.

Cassava: Based on Sahel's research, farmers do not typically attain the yield potential of improved cassava varieties as stated by the research institutes and record low crop yields, which impacts their willingness to purchase improved stems. Also, according to Oluwafemi, Z. O., Omonona, B. T., Adepoju, A. O., & Sowunmi, F. A. (2019) in their study on cassava productivity in Nigeria, and as revealed by Sahel's research, the limited access to extension services by farmers contributes to low cultivation of improved cassava stems as farmers are unaware of improved cassava varieties.

For instance, as found by Oluwafemi, et al., (2019), 98% of farmers surveyed reported no visits of extension service agents to their farms.

Yam: According to the Nigeria Early Generation Study (2016), the adoption of the improved yam varieties developed by NRCRI and IITA is low as farmers predominantly plant landrace varieties infested with diseases. The study found that insufficient on-farm demonstration trials by research institutes to prove the benefits of improved yam seeds to farmers have also limited their adoption of improved varieties. In their survey on farmers in Anambra state, Udemueze J.C and Nnabuife ELC (2017) further found that inadequate extension service was the biggest constraint to yam production and productivity as farmers are unaware of improved varieties to replace their old seed.

Soybean: According to Sahel's interviews, the adoption of improved varieties by farmers across Nigeria is low and can be attributed to the inadequate demonstrational trials and extension services to support the introduction of varieties to farmers. As such, farmers are unaware of newer and improved varieties of the crop. However, a soybean breeder within the NCRI revealed that farmers in Benue state, the highest soybean producing state in Nigeria, have begun to adopt new, improved varieties.

B. Limited Access to Quality Planting Materials

Maize: Interview respondents across the private seed companies interviewed stated that maize parental seed purchased by the companies from the NARIs are often of low quality and inadequate for their seed production, especially for hybrid seed. As highlighted by the Nigerian Early Generation Seed Study (2016) and confirmed by the seed companies interviewed, the volumes of breeder seed produced by the NARIs are inadequate to meet the demand for improved maize seed in Nigeria. While the inability of the NARIs to produce sufficient quality Early Generation Seed may be attributed to funding and infrastructural gaps at the institutes, the inadequate volumes of seed produced by the institutes impact seed production volumes, limiting the availability of certified seed to farmers.

To improve the access of seed companies to high-quality seed and reduce the reliance on the NARIs, various donor and development organizations such as AGRA and the BMGF have embarked on current programmes that provide funding and capacity-building support to some private seed companies to produce Early Generation Seed.

Cassava: The limited availability of quality stems certified by the National Agricultural Seed Council (NASC) hinders farmers' access to quality stems developed by the research institutes. Historically, there has been no clear means to delivering quality stems to farmers due to the poor capacity of the seed system to produce Early Generation Seed (breeder and foundation seed) for certified seed production and distribution. Based on insights from Sahel's extensive work in the cassava seed system, some farmers are largely unaware of where to purchase improved cassava stems and, as a result, reuse their stems from previous seasons or obtain old stems from other farmers. However, the trend of poor accessibility of stems is changing as the BMGF-funded BASICS project has recently supported the establishment of two Early Generation Seed companies in Oyo State and Abia State to produce foundation seed for seed entrepreneurs to produce certified stems for farmers to uptake. The BASICS project also establishes demand creation trials in collaboration with cassava processors to drive the demand for improved cassava varieties by end-users.

Yam: As revealed by the Nigeria Early Generation Seed Study in 2016, and like cassava, yam lacks a defined system for the distribution of seed to private seed companies who produce seed yam for commercial purposes. According to the study's findings, the NRCRI lacked the laboratory facilities, capacity, and expertise to multiply sufficient disease-free seed yam. However, based on Sahel's interviews and insights from its extensive work in the yam value chain, this trend is changing due to the promotion of novel seed production technologies under the YIIFSWA project. The project promotes Temporary Immersion Bioreactor System (TIBS) and Aeroponics System (AS) among research institutes and private seed companies to strengthen their production capacity for quality seed yam of improved varieties to be available for sale to farmers. Through the project, NRCRI and IITA have been equipped with the TIBS to produce yam disease-free vines and circumvent the limitations of producing conventional tissue culture materials for yam, such as insufficient ventilation, abnormal leaf functioning, high contamination, and labour costs. The research institutes supply vines as breeder seed to private seed companies for foundation and certified seed production. Five (5) private seed companies under the project have also adopted rapid multiplication technologies such as the Aeroponics System and hydroponics to multiply clean yam vines and produce seed yam tubers for sale to farmers.

C. Poor Agronomic Practices:

Generally, due to poor adherence to agronomic practices, farmers record low crop performance and yields, regardless of the crop type. Based on insights from Sahel's interviews across stakeholder groups, farmers often recycle seed multiple times and do not typically adhere to practices stated by the researchers or extension agents, ultimately impacting crop yields on their farms. For instance, some cassava farmers prefer to recycle cassava stems multiple times before purchasing new seeds for their production. Similarly, maize farmers plant seeds saved from their previous harvests, with some farmers planting grain as a seed to support their maize production. Researchers across the NARIs indicated that farmers also do not utilize the adequate quantity of seed recommended per hectare and non-seed inputs such as fertilizers, which also impacts crop yields on their farms.

D. Socio-Economic Factors:

Farmer profiles in Nigeria and socio-economic factors also influence the impact of research products. According to the National Survey and Segmentation Report on Smallholder Households in Nigeria by the Consultative Group to Assist the Poor (CGAP) (2017), 80% of farmers in Nigeria are smallholder farmers, holding less than 5 hectares of land and producing 99% of Nigeria's agricultural output. More than 72% of smallholder farmers in Nigeria live below the poverty line. (FAO, 2018).

Farmers typically face multiple challenges unrelated to research activities and constrain their agricultural activities, ultimately impacting their crop production, productivity, and income levels. These include high costs of agricultural inputs, estimated at almost 20% of the value of their production; reliance on rainfed agriculture and inadequate access to agriculture financing as only 7% of smallholder farmers have access to credit. Additional challenges include poor transportation infrastructure and a land tenure system that prevents the acquisition of new land (CGAP, 2017; FAO, 2018).

Conflicts arising from insurgencies and farmer-herder clashes in major food-producing states also disrupt agricultural activities such as planting and harvesting, hampering food production, and have also led to the destruction of crops. Destruction of crops due to pastoralist activities such as cattle grazing on farmlands across the country also contributes to low crop productivity on farmers' fields.

Chapter Summary

- Despite funding commitments for research and research focus across the various impact areas, the general impact on end-users, focusing on the crops within the categories of roots and tubers, cereals and legumes, is minimal.
- Although productivity research represents the largest research focus for each of the crops under the identified categories, the yield of all five (5) crops have only slightly increased, with some even decreasing within the timeframe of focus. For example, the yields of rice and maize have slightly increased while yields of cassava, yam and soybean have decreased over time. In general, all five (5) crops have recorded low yields when compared to best practices and the yield potential of the crops.
- While sustainability has also been a focus research area with funding commitments and given its effect on improving crop yields, yields remain low compared to the yield potential stated by research institutes.
- Despite funding commitment for nutrition through biofortification research for crops in Nigeria, such as cassava and maize, two (2) of the four (4) bio-fortified crops in Nigeria, Nigeria's nutritional status has remained stagnant between 2013 and 2018.
- There has been low research focus on climate resilience research for the crops than other impact areas, implying that the impact area has not been a priority focus area. Only maize recorded significant funding and research focus for the impact area, evident in the characteristics of the varieties released in Nigeria. The limited research on this impact area could also be related to the low crop productivity recorded as adverse weather conditions due to climate change negatively impacts the productivity of crops on fields.
- Factors such as the low adoption of improved varieties, limited access to quality planting materials, poor agronomic practices, and socio-economic factors such as conflicts, high cost of inputs, and poor agricultural financing also limit the impact of research findings on end-users.

RECOMMENDATIONS FOR REORIENTING THE FUTURE RESEARCH AND DEVELOPMENT AGENDA IN NIGERIA

This chapter will outline key recommendations to strengthen the research ecosystem in Nigeria and highlight future research priority areas for the NARS. It will include recommendations to reorient the future research and development agenda in Nigeria, based on the research gaps identified during interviews and the analysis of research funding data as received from the research institutes.

The table below summarizes the recommendations on improving the broad research ecosystem to address the current gaps within Nigeria's research landscape and the research priority areas for the reorientation of the future agricultural research and development agenda in Nigeria.

Table 13 - Summary of Recommendations

Recommendations on Improving the Research Ecosystem	• Develop an agricultural research strategy for Nigeria. • Build the capacity of the ARCN and NARIs to deliver on their national mandates. • Diversify and increase funding sources for research activities and institute structures to enhance the efficiency and effectiveness of fund allocation. • Transform the national and state-level extension service delivery system to bridge the linkage gap between researchers and end-users. • Ensure the protection of intellectual property rights (IPR). • Foster collaboration among the NARIs to ensure synergy and eliminate overlap of research activities.
Recommendations on Future Research Priority Areas	• Prioritize Climate Resilience and Nutrition research. • Promote the adoption and use of technology for data collection and management to inform research planning.

Recommendations on Improving the Research Ecosystem in Nigeria

In reorienting the future agricultural research and development agenda in Nigeria, it is crucial to ensure coordination in the research ecosystem to support the implementation of result-oriented research programmes. In this section, key recommendations for the effectiveness of the NARS are discussed, with rationales for each recommendation, a possible implementation timeframe, implementation partners and their roles, and potential risks that may impact its implementation.

Recommendation 1: Develop an Agricultural Research Strategy, hinged on the agricultural goals set under the National Development Plans and Agenda.

Rationale for the Recommendation

- **Lack of an Agricultural Research Policy in Nigeria:** There is currently no policy focused on agricultural research and development in Nigeria.

Recommended Action

a) **Introduce an Agricultural Research Strategy in Nigeria:** There is a critical need to introduce an agricultural research strategy in Nigeria to be implemented by the FMARD under which the NARS should operate. The development of the strategy should be hinged on the agricultural goals under the recently adopted Medium-term National Development Plan (MTNDP) for 2021 to 2025 and considered in the current development of additional plans by the FGN, such as the MTNDP for 2026 – 2030 and the Nigeria Agenda 2050. The strategy should include the critical national research priorities and themes to inform the focus of research activities of NARIs. The strategy should also adopt the recommendations stated in this report to ensure effective coordination within the NARS.

Possible Implementation Time Frame: 2 – 4 years

Potential Implementing Partners and their Roles:

Partners	Roles
The FGN, through the FMARD	• Introduce an agricultural research strategy for the sector hinged on the MTNDPs and National Agenda.
Policy Advocacy Groups, e.g., Nigeria Economic Summit Group (NESG)	• Engage with legislators and relevant stakeholders to advocate for the development and introduction of an agricultural research strategy.

Potential Risk: Bureaucracy by the government could hinder the implementation of the recommendation.

Recommendation 2: Build the Capacity of the ARCN and the NARIs to Deliver on their National Mandates within the National Agricultural Research System (NARS).

Rationale(s) for the Recommendation

- **Weak Governance Structure:** According to Babu et al. (2017), the weak governance structure within the ARCN and the NARIs is a major challenge within the NARS. Currently, the ARCN and each of the fifteen NARIs under its supervision have independent governing boards, and the policies adopted by the boards of the NARIs are not in alignment with those of ARCN (Babu et.al., 2017). There is the need to build the capacity of the ARCN and the NARIs to ensure that the institutions can effectively deliver on their roles within the NARS.

- **Lack of Oversight of the ARCN over the Budget Preparation by the NARIs:** The ARCN has limited involvement in the budget review process of the NARIs, posing a challenge to its effective coordination of research activities. Currently, the NARIs develop their budget independent of the ARCN, operating under the independent agendas of the NARIs, rendering the research budget of the NARS vulnerable, fragmented, and ineffective (Babu

et al., 2017). This action by the NARIs contravenes the ARCN Act that empowers the ARCN to prepare annual budgets for the NARIs under its supervision.

- **Poor Oversight of the ARCN over the Activities of Research Institutes and Agencies:** Currently, the ARCN does not provide oversight over all research institutes and agencies that conduct agricultural research in Nigeria, which limits its ability to coordinate agricultural-related research activities within the NARS effectively.

Recommended Actions

a) **Support the Implementation of the Agricultural Research Council Act (Amendment) Bill 2019 (SB. 118):** With the recent presidential assent of the Agricultural Research Council Act (Amendment) Bill 2019 in October 2021, which addresses most of the current governance and coordination shortfalls of the ARCN, it is crucial to ensure its implementation for a more effective NARS.

Possible Implementation Time Frame: 6 months – 1 year

Potential Implementing Partners and their Roles:

Partners	Roles
ARCN	- Collaborate with actors such as policy advocacy groups or civil society organizations to engage stakeholders and raise awareness of the law. - Set implementation timelines for specific actions detailed in the Act and develop a strategy with actionable steps for the implementation of the law.
Policy Advocacy Groups, e.g., Nigeria Economic Summit Group (NESG)	- Engage stakeholders in the landscape via convenings and dialogues, in collaboration with ARCN, to raise awareness of the law among stakeholders. - Support the development of implementation timelines for specific actions detailed in the law.

Potential Risk: Delay by the government in the implementation of the Act.

b) **Restructure the Governance Framework of the ARCN and the NARIs:** As recommended by the Steve Oronsaye report (2014) and as proposed by Babu et al. (2017), the board of the ARCN should be the only governing board for the NARS, to oversee and coordinate agricultural research in Nigeria, rather than the current independent boards of the NARIs which function simultaneously. As stated in the recently passed Agricultural Research Council Act (Amendment) Bill 2019, the governance shortfall of the ARCN has been addressed with the establishment of the Board of ARCN, as the central governing board for the NARS and the dissolution of the existing governing boards of the fifteen NARIs (See Appendix IX). The individuals to serve as technical experts on crops, livestock and fisheries to be included on the Board as stated by the Act, should be nominated from the NARIs, based on merit, and their experience.

All Board members should be eligible to serve for three (3) years, renewable for a second term based on performance and interest. Board members whose board memberships are tied to ministerial appointment or positions in associations can serve till the end of their appointed tenure.

In addition, with the dissolution of the existing governing boards of the NARIs, the NARIs should establish advisory boards comprised of thought leaders and experts from private sector organizations, commodity organizations and development organizations. The advisory board will provide additional guidance to the NARIs through support for the development of research agendas and the establishment of research priorities based on the industry's needs.

Possible Implementation Time Frame: 1 – 2 years

Potential Implementing Partners and their Roles:

Partners	Roles
FMARD	• Reconstitute the board of the ARCN to serve as the central governing board for agricultural research activities. • Nominate and select individuals from the various sectors as stated in the Act, to serve on the board of ARCN.
NARIs	• Establish advisory boards and nominate individuals to serve on the advisory boards.
Private Sector, Commodity and Development Organizations	• Serve on advisory boards of research institutes to guide their activities.

Potential Risk: Delay by the actors in the implementation of the recommendation.

c) **Empower ARCN to Oversee the Activities of all Relevant Research Institutes and Agencies that Conduct Agriculture Related Research:** All research institutes and agencies with the primary responsibility to conduct agriculture-related research and that are not currently under the supervision of the ARCN should be reassigned and placed under the direct supervision of the ARCN. While the recently passed Agricultural Research Council Act (Amendment) Bill 2019, now places institutions such as National Centre for Agricultural Mechanization (NCAM) and National Centre for Genetic Resources and Biotechnology (NACGRAB) under the supervision and control of ARCN, the Federal Institute of Industrial Research Oshodi (FIIRO) remains under the supervision of the Federal Ministry of Science and Technology (FMST).

The ARCN should also be empowered to oversee the agricultural and food research activities of FIIRO. This will ensure that RCN has direct oversight over all agricultural research activities within the NARS, including budget preparation for research activities

and approval, and can effectively communicate to all parties the status of agricultural research activities in the country.

Possible Implementation Time Frame: 1 – 2 years

Potential Implementing Partners and their Roles:

Partners	Roles
FGN	The FGN, through the FMARD and FMST, should • Assign all agriculture-focused research institutes under the supervision of the ARCN.
ARCN	• Oversee the research activities of all agriculture-focused research institutes, including their budget preparation and approval. • Collaborate with other agencies and research institutes that contribute to public agricultural research and provide oversight and input on their agricultural research activities and budget preparation to ensure oversight and effective coordination of agricultural research activities within the NARS. • Develop a robust information sharing framework between the NARIs and other agencies and research institutes that contribute to public agricultural research to ensure the effective communication of past and ongoing research activities within the NARS to all relevant parties

Potential Risk: Delay and bureaucracy by the Federal Ministries in the adoption and execution of the recommendation

d) **Provide Technical Assistance to Strengthen the Capacity of ARCN and the NARIs:** There is a need to strengthen the capacity of the ARCN and NARIs to deliver on their mandates.

This would involve a diagnosis of the current administrative and technical processes within ARCN and the NARIs and lead to comprehensive capacity building initiatives that engage the private sector to streamline and strengthen the institutions to deliver on their mandates. The diagnosis will also suggest training topics tailored to address identified gaps within ARCN and NARIs. Potential training topics include leveraging information technology to drive inclusive and sustainable agricultural research, developing proposals to attract international funding opportunities and leveraging partnerships with the private sector for effective research communication. These capacity building initiatives at the ARCN and NARIs will also include clear measurement and evaluation and feedback mechanisms that will foster a performance-driven culture within the institutions.

Furthermore, the ARCN should engage the private sector in developing a short-to-medium term strategic plan that will outline a stronger vision and mission and define core values for the institution. The strategic plan will also set clear objectives for the institution, with measurable outcomes.

Possible Implementation Time Frame: 1 – 2 years

Potential Implementing Partners and their Roles:

Partners	Roles
Private Sector Consultants and Trainers	• Lead the internal diagnosis and assessment of the NARIs. • Finalize training topics with the NARIs. • Develop training materials and curricula and identify training facilitators. • Conduct impact assessments of capacity building initiatives.
NARIs and the ARCN	• Collaborate with a consultant in conducting internal diagnosis and assessment of operational processes. • Suggest training topics based on knowledge of current gaps. • Provide centres for training.
Donor Organizations	• Serve as potential funding sources for the capacity building initiatives.

Potential Risk: Unavailability of funding and lack of willingness by ARCN and NARIs to share objective information during the internal diagnostics and assessments of NARIs.

Recommendation 3: Diversify and Increase Funding Sources for Research Activities and Institute Systems and Structures to Enhance the Efficiency and Effectiveness of Fund Allocation and Utilization.

Rationale(s) for the Recommendation

- **Inadequate Funding for Agricultural Research Activities:** The amount appropriated by the government to research institutes is inadequate for the implementation of agricultural research programmes. Based on the analysis of the data from the NARIs, and as corroborated by interview respondents, the funds disbursed to the institutes by the FGN are also usually lower than the appropriated amounts, which are already insufficient for research activities.

- **Absence of a Defined Funding Mechanism for Agricultural Research Activities:** This often results in funding allocation by the FGN based on the political will, which leads to uncertainties regarding the future availability of adequate funding for research and poses difficulties for long-term research planning. Although the FGN, under the Maputo Declaration, committed to allocating at least 1% of its agricultural Gross Domestic Product (GDP) to agricultural research and development, the appropriation of funds by the FGN falls short of this commitment. Nigeria's agricultural research and development spending as a share of its agricultural GDP fell from 0.39% in 2008 to 0.22% in 2014 (ASTI, 2017).

Recommended Actions

a) **Increase Government Funding for Agricultural Research:** The FGN should increase its agricultural research spending to the African Union target of at least 1% of agricultural GDP to ensure that the NARIs are better equipped with the financial resources needed to conduct research activities. To ensure that funds disbursed to the NARIs are utilized effectively and efficiently to conduct and support research efforts, each NARI should undergo annual audits by reputable external audit firms.

Possible Implementation Time Frame: Short to Medium Term (1 – 4 years)

Potential Implementing Partners and their Roles:

Partners	Roles
FGN	The FGN, through the Ministry of Finance, Budget and National Planning, should: • Increase annual funding allocation for agricultural research to at least 1% of the agricultural GDP of the previous year. • Ensure timely disbursements of funds to the NARIs to support the conduct of timely research.
ARCN	• Monitor research spending by the NARIs to ensure that allocated funds for research are utilized as intended. • Engage external audit firms to conduct annual audits of the NARIs.

Potential Risk: Bureaucracies by the government could delay implementation of the recommendation; inconsistent increase in the annual budgetary allocations to the NARIs could disrupt research activities and commitments.

b) **Establish an Agricultural Research Challenge Fund:** Apart from the statutory funding allocation for agricultural research through the national budget, the ARCN should facilitate the establishment of a research innovation fund for NARIs to access additional funding for agricultural research programmes. The fund should be set up as a competitive innovation fund, channelled through the proposed National Agricultural Development Extension Fund as stated in the ARCN reform bill, and pool funds from private sector companies and donor organizations. However, the funding requirement of 1% of profits, before tax from private sector organizations that have an annual turnover of NGN 100,000,000 and above, should be limited to organizations that operate in the agricultural sector, instead of organizations across various sectors as outlined in the ARCN reform bill.

It is important to institute a strong management structure to enhance efficiency and effectiveness in the allocation and utilization of the fund. As such, the fund should be managed by a committee of research and investment experts who will determine the fund's eligibility criteria and review applications from researchers seeking funding. To be eligible for the fund, researchers must submit concept notes highlighting the relevance of their proposed research in addressing market needs. Researchers applying for funding must ensure that proposed research activities are linked to measurable outcomes, with

applications demonstrating a detailed approach to ensuring knowledge management and end-users' uptake.

Possible Implementation Time Frame: 1 - 4 years

Potential Implementing Partners and their Roles:

Partners	Roles
ARCN	• Facilitate the establishment of the fund by collaborating with other stakeholders in the research system. • Constitute an independent fund management committee comprising experts from the private sector, NGOs, and investment landscape.
Private Sector Organizations	• Adhere to the ARCN reform bill upon its passage and contribute 1% of profit before tax to the National Agricultural Development Extension Fund as applicable.
NARIs and Research Scientists	• Develop concept notes for review by the fund management and administration committee. • Develop and defend research proposals and implement activities upon successful application.
Donor and Development Organizations	• Contribute to the National Agricultural Development Extension Fund.

Potential Risk: The limited capacity of the ARCN to drive the establishment of the challenge fund could hinder the timely implementation of the recommendation.

Recommendation 4: Transform the national and state-level extension service delivery system to bridge the linkage gap between researchers and end-users, and ensure demand-driven research and the efficient commercialization of innovative solutions.

Rationale for the Recommendation

- **Existing Linkage Gap between Research and End-Users:** Sahel's interviews indicate that there is an existing gap in the linkage between research conducted by the NARIs and end-users, which has led to limited uptake of research technologies by farmers and the industry at large. As highlighted by interview respondents, the major factor responsible for this gap is the weak research-extension-farmer-input linkage systems. While the NARIs have units dedicated to extension service delivery, these units have either been neglected, leading to reduced capacity to deliver services or no longer exist.

  The ADPs also face capacity constraints that limit their ability to collaborate with research institutes and educational institutions to transfer research findings to end-users. For instance, according to the national Agricultural Performance Survey 2019, the ratio of extension agents to farmers ranged from 1:1,000 to 1:18,435, against the Food and Agricultural Organization's recommendation of 1:500 to 1:800. Sahel's stakeholder

interviews further indicate that the current weak extension system is a major limitation to the adoption of improved crop varieties and good farming practices by farmers, as stated earlier in the report.

Recommended Action

a) **Adopt a Private Sector Led Agricultural Extension Delivery System:** The NARIs should engage private sector agricultural service providers in extension service delivery to bridge the linkage gap between research and end-users, ensure demand-driven research and efficient commercialization of innovative solutions.

Several private sector organizations in Nigeria have linkages to farmers and out-growers, providing them with a range of services such as cluster formation, training, input loans, insurance services, mechanization support, and credit facilities to increase productivity and enhance market access. Specifically, some private agricultural service providers and processors are operating viable and scalable farmer engagement models that can support the demonstration and adoption of innovative solutions from the NARIs and ensure demand-driven research.

Possible Implementation Time Frame: 2 – 4 years

Potential Implementing Partners and their Roles:

Partners	Roles
Research Institutes	• Facilitate the collaboration with private sector organizations to bridge the linkage gap between researchers and end-users. • Develop Memorandums of Understanding (MoUs) with private sector organizations, detailing areas of collaboration.
Private Sector Organizations	• Partner with the research institutes and educational institutions to support extension service delivery of new research technologies to end-users.

Potential Risk: Unwillingness and lack of commitment by the research institutes to drive engagements and develop sustainable partnerships with the private sector organizations.

b) **Strengthen Existing Research-Extension–Farmer-Input Linkage System (REFILS):** The ARCN should task the NAERLS with the development of a national REFILS strategy to be coordinated nationwide by NAERLS, with support from the extension units of the various NARIs and officers of the ADPs.

The State Ministries of Agriculture should strengthen the ADPs in their respective states through active recruitment and training of extension agents to ensure that they are better equipped to support the activities of research institutes in disseminating research findings.

Possible Implementation Time Frame: 1 – 4 years

Potential Implementing Partners and their Roles:

Partners	Roles
ARCN	• Engage NAERLS to develop a national REFILS strategy to support the dissemination of research findings and extension services.
State Ministries of Agriculture	• Strengthen the ADPs to empower them to support the dissemination of research findings.
NARIs	• Collaborate with the ADPs to disseminate research findings to end-users

Potential Risk: Inadequate human resource and technical capacity of the extension units of the NARIs and state ADPs could hinder the implementation of the recommendation.

Recommendation 5: Ensure the Protection of Intellectual Property Rights (IPR) of Researchers and Clear Adherence to Protocols for the Use of Research.

Rationale for Recommendation

- **Lack of an IPR Law:** Currently, there are no laws that protect the IPR of researchers, which hinders the participation of the private sector in agricultural research in Nigeria.[16] For instance, based on interviews with key stakeholder groups, private and international seed companies are reluctant to share their proprietary research with other stakeholders within the NARS, such as the NARIs, due to the lack of a law that protects IPR of researchers. Based on insights from Sahel's interviews, this limits the potential of the local seed industry to attract private and international seed companies and investors who can contribute to agricultural research that advance crop varietal development in Nigeria.

Recommended Action

a) **Introduce a Strong IPR Law:** The FGN should prioritize the introduction of a strong IPR law to provide an enabling environment for private sector stakeholders to contribute to agricultural research and development efforts. The introduction of an IPR protection law will alleviate concerns of private sector stakeholders and international companies regarding contribution to agricultural research in Nigeria and improve their willingness to participate in research efforts. The resulting increase in private sector participation in agricultural research can lead to the introduction of more innovative agricultural solutions that will benefit end-users. The law must also detail clear guidelines and protocols that users of agricultural research must follow to ensure its effectiveness.

Possible Implementation Time Frame: 1 – 2 years

Potential Implementing Partners and their Roles:

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[16] There has been a recent development in this area through the development of the Plant Variety Protection (PVP) bill which is set to provide breeder rights to plant breeders who develop new and improved crop varieties. The bill has passed a review by the Committee of the Whole in 2021.

Partners	Roles
Federal Government of Nigeria and Members of the National Assembly	• Prioritize the introduction and enforcement of an IPR law to protect researchers and encourage the participation of private sector organizations in agricultural research efforts.
Policy Advocacy Groups	• Engage with legislators and relevant stakeholders to advocate for the introduction of an IPR bill that is reflective of the needs of the NARS

Potential Risk: Delays in the passage of bills into law could extend the implementation period of the recommendation.

Recommendation 6: Foster Collaboration Among the NARIs to Ensure Synergy, Eliminate Overlap of Research Activities and Promote Efficient Communication and Knowledge Sharing.

Rationale for the Recommendation

- **Weak Collaboration between the Commodity-focused NARIs and the non-commodity focused NARIs:** As stated earlier in the report, collaboration among the NARIs, especially between the commodity-focused NARIs and the non-commodity focused NARIs is weak and results in a lack of synergy among the two groups. This weak collaboration limits the awareness of the two groups on ongoing research that may benefit their activities, leading to duplication of efforts of the commodity and non-commodity focused NARIs as both groups may be conducting similar research studies activities, independent of each other.

Recommended Action

a) **Develop Coordinated Research Themes for the NARIs and Create a Platform for Knowledge Sharing:** Similar to the Nigeria Site Integration Plan of the CGIAR, the development of research themes and priorities for NARIs should be coordinated by ARCN at the national level and based on the needs of end-users. The research themes and priorities will outline the research focus of the NARIs for a given period. It will also highlight cross-cutting research areas to foster collaboration among the institutes and promote accountability.

The ARCN should also develop and manage a knowledge management portal containing information on past and current research efforts of the NARIs to ensure knowledge sharing and transfer. Designated departments within each of the NARIs will be responsible for updating the portal with research activities and efforts of the institute. The portal should be publicly accessible by all NARIs and end-users to ensure access to information on research efforts in Nigeria.

Possible Implementation Time Frame: 2 – 4 years

Potential Implementing Partners and their Roles:

Partners	Roles
ARCN	• Facilitate the development of research themes and priorities for NARIs. • Oversee the conduct of research and implementation of the research agenda by NARIs. • Hold research institutes accountable to their research commitments. • Develop and manage the knowledge management portal to ensure knowledge sharing and transfer.
NARIs	• Contribute to the development of periodic national research agenda highlighting research themes and priorities. • Conduct research based on research themes and priorities. • Collaborate with other research institutes to conduct result-oriented research. • Develop knowledge sharing mechanisms to ensure the flow of information with the NARIs. • Update the knowledge management portal with past and current research efforts of the institute.

Potential Risks: Further delay in the passage of the ARCN bill and the limited capacity of the ARCN to coordinate the agricultural research ecosystem may affect the implementation of this recommendation.

Recommendations on Future Research Priority Areas

In addition to strengthening the capacity of the research ecosystem to effectively coordinate and conduct research, based on insights from stakeholder interviews and Sahel analysis, the following key research areas must be prioritized in the reorientation of the future research and development agenda in Nigeria.

Priority 1: Prioritize Climate Resilience and Nutrition Research

Based on the analysis of the data received from the NARIs and additional insights from Sahel's interviews, the research commitment in the impact area of nutrition and climate resilience across most of the five selected crops is low, with limited funding commitment, compared to the other focus impact areas.

The limited commitment to research on climate resilience across the crops, except for maize, and as evident in the funding trends between 2014 and 2019, could be a potential factor that continues to limit the productivity of crops, despite the increased funding and research commitment to improving crop yields and productivity. As such, the NARIs and the Federal Government of Nigeria (FGN) need to prioritize climate resilience research through increased funding allocation to the area to spur the development of low-cost, adaptable climate-smart innovations and identification of climate-sensitive agricultural practices that will mitigate the increasing impact of climate change on crop productivity and food production in the various parts of Nigeria.

Also, funding, and research on nutrition across the selected crops, asides from cassava, is low and has had minimal impact on the overall improvement of the nutritional status in the country. While nutrition research is the third-largest funded research area in total and across the five selected crops, the funding amount is largely driven by funding for research to improve the nutritional value of cassava, at over 63% of the total funding for the five crops between 2014 – 2019. Of the five crops, cassava and maize are currently two (2) of the four (4) bio-fortified crops in Nigeria, and the ARCN and NARIs should consider mandating agricultural research for the bio-fortification of additional staple crops such as yam and rice, which are widely consumed in Nigeria. This will also require additional funding to the NARIs for nutrition research from the FGN.

Priority 2: Promote the Adoption and Use of Technology and Data Collection and Management to Inform Research Planning

Based on Sahel's interviews and analysis, the widespread adoption and use of modern and digital technology in data collection in the agriculture landscape is still low. The NARIs lack the technology and capabilities to gather and analyse agriculture and food data on their research mandate crops to drive research planning and execution.

The NARIs must identify and collaborate with relevant organizations to build capability in data-driven research planning using appropriate technology. NARIs may explore collaboration with other international research institutes that focus on similar research categories and engage in knowledge sharing and exchange programmes to build the capability and experience of key staff in the collection, analysis, and use of industry data to identify trends and gaps that could inform research planning.

CONCLUSION

Across the NARS, several gaps hinder the coordination and conduct of research activities. These include the lack of an agricultural research strategy under which agricultural research activities are coordinated; the limited capacity of the ARCN and the NARIs; inadequate funding for agricultural research; poor research transfer to end-users due to weak linkages between researchers and end-users; lack of protection for intellectual property rights; and poor collaboration between the NARIs.

The reorientation of the agriculture and food research agenda in Nigeria calls for the strengthening of the capacity of the NARS to conduct and manage research activities and prioritize specific research areas that will address the current research gaps. There is a need for a strategy solely focused on agricultural research and hinged under the agriculture goals of the current Medium-term National Development Plans 2021 – 2025. The capacity of the ARCN and the NARIs must also be strengthened through effective governance and technical assistance to deliver on their respective mandates of research coordination and conduct in Nigeria.

Furthermore, there is a consensus from stakeholders that adequate funding to support research activities is critical in advancing agricultural research. In addition to funding commitment by the FGN to the NARIs for agricultural from the budget, the private sector should also be encouraged to fund agricultural research. Building strong linkages between researchers and end-users through private sector engagement in extension service delivery is critical to ensure that the demands of end-users inform the research priorities of the NARIs.

The existence of a strong law that protects the IPR of researchers is crucial to encourage private sector participation in agricultural research, which could lead to the introduction of new and improved research technologies. The NARIs must also actively collaborate and utilize knowledge sharing mechanisms to ensure synergy and eliminate duplication of efforts within the NARS.

Actors within the NARS must also prioritize research for climate resilience in agriculture and nutrition to mitigate the increasing effects of climate change on food production. Also, research institutes should collaborate with relevant organizations to build capability in data-driven research planning and impact analysis using appropriate technology.

The transformation of Nigeria's agriculture research ecosystem will require significant political will from the national government, including the presidency, as well as cooperation and support from the private sector and the development and funding community. Ultimately, the ability to create a demand-driven research agenda at the ARCN and create a performance-driven culture among the NARIs will eventually foster growth and development in the Nigerian agriculture landscape and food ecosystem.

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APPENDICES

APPENDIX I

Stakeholder Group	Role of Interviewee
Government Ministries and Agencies	• Directors • Deputy Directors • Head of Partnerships and Donor Projects
Research Institutes	• Executive Directors • Department Directors • Programme Directors • Breeders and Seed Specialists • Head of Administration
Educational Institutions	• Professors • Heads of Department, e.g., Department of Plant Science and Crop Production
Private Sector Organizations	Depending on the type of organization, Sahel engaged: • Directors • Breeders • Supply Chain Director
Farmer Associations	• Leaders of Farmer Associations
Donors and Development Organizations	• Country Directors • Programme Directors

APPENDIX II

Research Institute	Information Provided	Missing Information
Institute for Agricultural Research & Training	Total funding disbursed from the Government, donor and development organizations and private sector organizations	
National Horticultural Research Institute	Total funding disbursed from the Government, donor and development organizations and private sector organizations	
National Cereals Research Institute	Total funding disbursed from the Government, donor, and development organizations	
Nigerian Stored Products Research Institute	Total funding disbursed from the Government, donor, and development organizations	
Institute for Agricultural Research	Total funding disbursed from the Government, donors and development organizations and private sector organizations	
National Agricultural Extension and Research Liaison Services	Total funding disbursed from the Government, donors, and development organizations	The breakdown of funding received by costs category of personnel, overhead and capital expenses
National Institute for Freshwater Fisheries Research	Total funding disbursed from the Government	
National Root Crops Research Institute	Total funding disbursed from the Government	• Total funding received from donors and private sector organizations. • The breakdown of funding received by cost category or personnel, overhead and capital expenses
National Animal Production Research Institute	No information provided	Total funding disbursed from the Government, donors and development organizations and private sector organizations
International Institute for Tropical Agriculture	Total funding budgeted for agricultural research projects in Nigeria	Actual funding disbursed for agricultural research projects in Nigeria

APPENDIX III

Agencies	Responsibility	Location
Agricultural Research Council of Nigeria (ARCN)	Coordination of agricultural research and development	Abuja
Nigeria Agriculture Quarantine Service (NAQS)	Regulation of sanitary and phytosanitary measures for plants, veterinary and aquatic resources	Abuja
Bank of Agriculture (BoA)	Provision of credit to support agricultural activities	Kaduna
Agricultural and Rural Management Training Institute (ARMTI)	Development of interventions to improve managerial practice in the agricultural and rural sector	Ilorin
National Centre for Agricultural Mechanization (NCAM)	Mechanization of agriculture through innovative research	Ilorin
Nigerian Agricultural Insurance Corporation (NAIC)	Provision of agricultural risk insurance	Abuja
National Agricultural Seeds Council (NASC)	Development and regulation of the seed industry	Abuja
Nigeria Institute of Animal Science (NIAS)	Regulation of animal husbandry	Abuja
Nigeria Institute of Soil Science (NISS)	Regulation of the soil science profession	Abuja
Veterinary Council of Nigeria (VCN)	Regulation of the standard of training and practice of the veterinary profession	Abuja
National Agricultural Land Development Authority (NALDA)	Provision of support for land development	Abuja

APPENDIX IV

Research Institutes	Location
National Institute of Fresh Fisheries Research (NFFR)	New Bussa
Cocoa Research Institute of Nigeria (CRIN)	Ibadan, Oyo
National Veterinary Research Institute (NVRI)	Vom, Plateau
National Cereals Research Institute (NCRI)	Badeggi, Niger
National Animal Production Research Institute (NAPRI)	Abuja, FCT
National Agricultural Extension Research Liaison Services (NAERLS)	Zaria, Kaduna
Nigerian Institute for Oil Palm Research	Benin, Edo
National Institute of Oceanography and Marine Research (NIOMR)	Lagos
Nigerian Stored Products Research Institute (NSPRI)	Ilorin, Kwara
Lake Chad Research Institute	Maiduguri
Institute of Agricultural Research (IAR)	Zaria, Kaduna
Institute of Agricultural Research and Training (IAR & T)	Ibadan, Oyo
National Roots Crops Research Institute (NRCRI)	Umudike, Abia
Rubber Research Institute of Nigeria (RRIN)	Benin, Edo
National Horticultural Research Institute (NIHORT)	Abuja, FCT

APPENDIX V

Educational Institutions	Location
Universities	
Federal University of Agriculture, Abeokuta	Ogun
University of Agriculture, Makurdi	Benue
Michael Okpara University of Agriculture, Umudike	Abia
FCAs	
Federal College of Agriculture, Akure	Ondo
Federal College of Agriculture, Ibadan	Oyo
Federal College of Agriculture, Ishiagu	Ebonyi
Samaru College of Agriculture, Zaria	Kaduna
College of Agriculture, Kabba	Kogi
Federal College of Forestry Mechanization, Afaka	Kaduna
Federal College of Forestry, Ibadan	Oyo
Federal College of Forestry, Jos	Plateau
Federal College of Horticulture, Dadin-Kowa	Gombe
Federal College of Animal Health and Production Technology, Ibadan	Oyo
Federal College of Land Resources Technology, Jos	Plateau
Federal College of Land Resources Technology, Owerri	Imo
Federal College of Freshwater Fisheries Technology, Baga	Borno
Federal College of Fisheries and Marine Technology, Lagos	Lagos
Federal College of Animal Health and Production Technology, Vom	Plateau
Federal College of Wildlife Management, New Bussa	Niger

The
eleven (11) Federal Colleges of Agriculture under the direct oversight of ARCN include:
- Federal College of Agriculture Ibadan, Oyo State
- Federal College of Agriculture Akure, Ondo State
- Federal College of Agriculture Ishiagu, Ebonyi State
- Federal College of Animal Health and Production Technology, Vom, Plateau State
- Federal College of Animal Health and Production Technology, Ibadan, Oyo State
- Federal College of Veterinary and Medical Laboratory Technology, Vom, Plateau State
- Federal College of Agricultural Produce Technology Kano, Kano State
- Federal College of Freshwaters Fisheries Technology, New Bussa, Niger State
- Federal College of Freshwater Fisheries Technology, Baga, Borno State
- Federal College of Fisheries and Marine Technology Lagos, Lagos State
- Federal College of Horticulture, Dadin Kowa, Gombe State

APPENDIX VI

S/N	Research Institute	Year of Establishment	Location	Formal Mandate
1	Institute for Agricultural Research	1922	Zaria, Kaduna	Genetic improvement and development of production and utilization technologies for sorghum, maize, cowpea, groundnut, cotton, sunflower, and the improvement of the productivity of the entire crop-based farming system in the North West Zone of Nigeria
2	Institute of Agricultural Research and Training	1956	Ibadan, Oyo	Soil and water management research, genetic improvement of kenaf and jute, maize and legume crops, and improvement of the productivity of the entire farming system of the South West Zone of Nigeria
3	National Cereals Research Institute	1975	Badeggi, Niger	Genetic improvement and production of rice, soybean, benniseed, castor, acha and sugarcane and improvement of productivity of the entire farming system of the Central Zone
4	National Horticulture Research Institute	1975	Ibadan, Oyo	Research into genetic improvement, production, processing and utilization of fruits and vegetables, as well as ornamental plants
5	National Root Crop Research Institute	1976	Umudike, Abia	Genetic improvement of cassava, yam, cocoyam, Irish potato, sweet potato, and ginger and overall research in the improvement of the farming system of the South East Zone
6	Lake Chad Research Institute	1960	Maiduguri, Borno	Genetic improvement and development of production technologies for wheat, millet, and barley; the improvement of the productivity of the entire farming system in the North Eastern zone.
7	Nigerian Institute for Oil Palm Research	1939	Benin City, Edo	Research into genetic improvement, production and processing of oil palm, coconut tree, date palm, raffia palm and ornamental palms
8	Rubber Research Institute of Nigeria	1961	Benin City, Edo	Research into genetic improvement, production and processing of rubber and other lather producing plants
9	Cocoa Research Institute of Nigeria	1964	Ibadan, Oyo	Genetic improvement, production and local utilization research on cocoa, cashew, kola, coffee, and tea

S/N	Research Institute	Year of Establishment	Location	Formal Mandate
10	National Institute for Freshwater Fisheries	1968	New Bussa, Niger	Research into all freshwater fisheries and long-term effects of man-made lakes on ecology and environment throughout the country
11	Nigerian Institute for Oceanography and Marine	1975	Lagos	Research into the resources and physical characteristics of Nigerian territorial waters and the high seas beyond; genetic improvement, production and processing of brackish water and marine fisheries
12	National Veterinary Research Institute	1924	Vom, Plateau	Research into all aspects of animal diseases, their treatment and control, as well as development and production of animal vaccines and sera
13	National Animal Production Research Institute	1977	Zaria, Kaduna	Research on food animal species and forages
14	National Agricultural Extension, Research and Liaison Services	1975	Zaria, Kaduna	Research into technology transfer and adoption studies; overall planning and development of extension liaison activities nationally; collation and evaluation of agricultural information
15	Nigerian Stored Product Research Institute	1977	Ilorin, Kwara	Research into improvement of major food and industrial crops and studies on stored product pest and diseases, pesticides formulation and residue analysis

S/N	Research Institute	Year of Establishment	Location	Formal Mandate
Under the Supervision of FMARD				
1	National Centre for Agricultural Mechanization (NCAM)	1990	Ilorin, Kwara	To mechanize Nigeria's agriculture through innovative research and the development of simple and low-cost technologies using locally sourced materials to eliminate drudgery in farming and improve agricultural productivity.
Under the Supervision of the Federal Ministry of Science and Technology				

S/N	Research Institute	Year of Establishment	Location	Formal Mandate
2	Federal Institute of Industrial Research Oshodi	1956	Oshodi, Lagos	To assist in accelerating the industrialization of the Nigerian economy through finding utilization for the country's raw materials and upgrading indigenous production technologies specifically to: identify and characterize local raw materials for use in industries; develop appropriate technologies; upgrading indigenous technologies in the area of food and agro-allied processing and various non-food areas; develop pilot-scale operations; assist in the transfer, adaptation and utilization of these technologies by local enterprises
3	National Centre for Genetic Resources and Biotechnology	1987	Ibadan, Oyo	To conduct research, gather data and disseminate technological information on matters relating to genetic resources conservation, utilization, and biotechnology applications
4	National Biotechnology Development Agency	2001	Abuja	To promote, coordinate and deploy innovative biotechnology research and development, processes, and products for the socio-economic well-being of the nation
5	Nigeria Institute for Trypanosomiasis Research		Kaduna	To conduct research and development for the control and eradication of Trypanosomiasis and Onchocerciasis in all the geo-ecological zones of Nigeria to promote food security, rural development, improve human and animal health and facilitate sustainable agriculture practice through optimum land use
6	Project Development Institute	1971	Enugu	To conduct research into industrial materials and processes to pilot plant stages, including engineering design, development, and fabrication
7	National Research Institute for Chemical Technology	1988	Zaria, Kaduna	To develop the technologies required by the chemicals industry and undertake research and development work into the; processing for the conversion of agricultural, mineral and other raw materials into chemicals; the processing of commercial-grade chemicals to laboratory grades; derivation of secondary chemicals from petrochemicals, coal chemicals, etc.; production of functional polymers and engineering plastics, their characterization and utilization; the processing of hides and skins into leather products, and the processing of natural man-made fibres.
Under the Supervision of the Federal Ministry of Environment				

S/N	Research Institute	Year of Establishment	Location	Formal Mandate
8	Forestry Research Institute of Nigeria	1954	Ibadan, Oyo	To conduct research into all aspects of Forestry, Wildlife Management, Agroforestry and Forest Products Utilization and to train technical and sub-technical personnel for forestry services and other agro-allied services in the country.

APPENDIX VII

Research Institutes	Locations in Nigeria	Research Priority Areas
International Institute of Tropical Agriculture (IITA)	Ibadan, Oyo Abuja, FCT Kano, Kano Onne, Rivers	**Food Crops:** Banana, Plantain, Cassava, Yam, Cowpea, Maize and Soybean
International Crops Research Institute for the Semi-Arid Tropics (ICRISAT)	Kano, Kano	**Food Crops:** Pearl millet, Sorghum, Groundnut, Chickpea and Pigeon pea
International Food Policy Research Institute (IFPRI)	Abuja, FCT	**Food Policy**
International Potato Centre (CIP)	Abuja, FCT	**Food Crops:** Potato, Sweet Potato
International Livestock Research Institute (ILRI)	Ibadan, Oyo	**Livestock**
Africa Rice Centre	Ibadan, Oyo	**Food Crops:** Rice

Thematic Category	Policy Themes	2H 2016	1H 2017	2H 2017	1H 2018	2H 2018	1H 2019	2H 2020
Productivity Enhancements	17. Access to Land	Blue	Blue	Yellow	Green	Green	Green	Yellow
	18. Soil Fertility	Blue	Blue	Yellow	Green	Green	Green	Yellow
	19. Access to Information and knowledge	Blue	Blue	Yellow	Green	Green	Green	Yellow
	20. Access to Inputs	Blue	Blue	Yellow	Green	Green	Green	Yellow
	21. Production Management	Blue	Blue	Yellow	Green	Green	Green	Yellow
	22. Storage	Green	Green	Green	Yellow	Yellow	Blue	Blue
	23. Processing	Green	Green	Green	Yellow	Yellow	Blue	Blue
	24. Marketing & Trade	Green	Green	Green	Yellow	Yellow	Blue	Blue
Crowding in Private Sector Investment	25. Access to Finance	Green	Green	Green	Yellow	Yellow	Blue	Blue
	26. Agribusiness Investment Development	Green	Green	Green	Yellow	Yellow	Blue	Blue
FMARD Institutional Realignment	27. Institutional Setting and Roles	Green	Green	Green	White	White	White	White
	28. Youth and Women	Yellow	Yellow	Yellow	Green	Green	Green	Green
	29. Infrastructure	Green	Green	Green	Green	Green	Green	Green
	30. Climate Smart Agriculture	Blue	Blue	Blue	Green	Green	Green	Green
	31. Research & Innovation	Yellow	Yellow	Yellow	Green	Green	Green	Green
	32. Food, Consumption and Nutrition Security	Green	Green	Green	Green	Yellow	Yellow	Yellow

Legend	Light Touch	Moderate Support	Heavy Support
Definition	Limited Naira and persons allocated; maintenance mode	50% of budgeted investment, persons and political support	100% of budgeted investment, persons and political support
Colour Code	Blue	Yellow	Green

Source: The Agriculture Promotion Policy (2016 – 2020)

APPENDIX IX

Some key components of the Agricultural Research Council of Nigeria (Repeal and Enactment) Bill (HB 69) and the recently passed Agricultural Research Council Act (Amendment) Bill 2019 (SB. 118) are highlighted below:

Establishment of a Governing Board for the Council

The Board shall consist of the following members to be appointed by the President:

a. The Chairman who shall be a person in any of the fields of agricultural sciences with cognate wide knowledge and experience
b. The Permanent Secretary of the Federal Ministry of Agriculture and Rural Development
c. The Permanent Secretary of the Federal Ministry of Industry, Trade and Investment
d. The Permanent Secretary of the Federal Ministry of Science and Technology
e. The Permanent Secretary of the Farmers Association of Nigeria
f. The Chairman of the Agric Business Group of the Manufacturers Association of Nigeria
g. A Technical expert each with wide knowledge and experience in crops, livestock and fisheries, and
h. The Executive Secretary of the Council

Functions of the Council

The functions of the Council shall be to:

a. Advise the Federal Government on national policies and priorities in agricultural research training and extension activities
b. Manage, plan, conduct and promote research, human resource development and technology generation, assessment, and adoption for the advancement of all aspects of agriculture in Nigeria.
c. Prepare periodic master plans for agricultural research, training and extension and advise the Federal Government on the financial requirement for the implementation of such plans
d. Ensure the implementation of the approved master plans by the appropriate research institutes, universities and other bodies
e. Participate in the process of the appointment of Directors of agricultural research institutes established under university statutes, by Vice Chancellors.
f. Prescribe and provide policy direction to the Federal Colleges of Agriculture on their training and extension activities
g. Supervise research, training and extension activities of research institutes
h. Prepare the annual budget for agricultural research, training and extension programmes of the institutes under its aegis and receive grants for allocation to the institutes for the implementation of the annual programmes and to universities and other bodies for special research or training projects
i. Maintain an up-to-date record of all existing facilities for research, training and extension in the agricultural sciences in Nigeria and advise the Federal Government on their adequacy and efficient utilization
j. Advise the Federal Government on the re-organization of existing institutes, including the creation of new ones, as are required to implement or further the efficiency of research, training and extension in the agricultural sciences
k. Promote collaboration between scientists engaged in research in the agricultural sciences in Nigeria and their counterparts in other countries or international bodies

l.   Establish and maintain a National Agricultural Science Library and Documentation Centre and publish or sponsor the publication of research results in the agricultural sciences, and

m. Carry out such activities as may, in the opinion of the Council, further the advancement of research, training and extension in the agricultural sciences

Funding of the Council

Both the SB 118 and HB 69 bills proposed the establishment of a National Agricultural Research and Extension Fund, to be applied exclusively for agricultural research, training and extension, with slight differences in how the fund will be financed.

The SB 118 bill proposes that the fund will be financed by:

- 1% of the duties on agricultural imports and exports
- 1% of annual profit of agricultural producers in Nigeria
- Other monies as may be determined by the Federal Government from time to time.

The HB 69 bill proposes that the fund be financed by:

- 1% of the duties, levies, and charges on agricultural imports and exports
- 1% of the profit before tax of companies within various sectors such as, telecommunications, information technology, financial services, agriculture, healthcare, hospitality, transportation, brewery and tobacco, construction, media and advertising and logistics, with an annual turnover of NGN 100 million
- Grants-in-aid and assistance from bilateral and multilateral agencies
- Gifts, endowments, bequests, and contributions, subject to certain conditions
- Appropriations to the Fund by the National Assembly
- Other monies or assets that may from time to time accrue to the Fund

Based on the new provisions, both the Nigeria Customs Service and the Federal Inland Revenue Service will be responsible for collecting the applicable levies, taxes etc. and directly remitting it to the Council's Fund.

Staff of the Council

Proposes that the Board shall, subject to the approval of the Minister for Agriculture and Rural Development, appoint the following Deputy Executive Secretaries:

- Crops
- Livestock, Fisheries & Marine
- Training & Extension
- Technical Cooperation and Communication
- Administration and Finance

Other Critical Provisions/Amendments

- Stipulates the procedure for the establishment of Federal Colleges of Agriculture and proposes that existing and future Colleges of Agriculture be deemed to be established under the ARCN Amendment Act.
- Proposes for the Council, Research Institutes and Colleges under Act to have the power to incorporate spin-off companies or enter public-private partnerships in the agricultural research system in Nigeria. These spin-off companies and public-private partnerships will provide the platform for the commercialization, privatization and marketing of scientific, agricultural, and technological discoveries, innovations and findings of products developed by the NARIs and colleges.

- Proposes that research institutes established for agricultural research under the Nigerian Research Institutes Act 1964 and the Research Institutes (Establishment, etc.) Order 1975 be deemed to be established under the ARCN Amendment Act.
- Proposes that the governing councils and boards of the research institutes under its supervision be dissolved, and that staff of the existing research institutes be deemed employees of the Council.
- Proposes that the National Centre for Agricultural Mechanization, National Centre for Genetic Resources and Biotechnology, the Federal College of Cooperatives, and the Federal College for Land Resources Technology, respectively under the Departments of Cooperatives and Agricultural Land Resources of the Ministry, be deemed to be established under the ARCN Amendment Act.

The bill repeals the Research Institutes Act 1964, the Research Institutes (Establishment, etc.) Order 1975 and the National Centre for Agricultural Mechanization Act 1990.

Source: Agricultural Research Council of Nigeria (Repeal and Enactment) Bill (HB 69) and the Agricultural Research Council Act (Amendment) Bill 2019 (SB. 118), (2021)

APPENDIX X

The table below shows the cassava varieties developed and released in Nigeria since 2009:

Variety Name	Developing Institute	Characteristics	Yield Potential (MT/Ha)	Agro-ecological Zones	Year of Release
NR 01/0004	NRCRI, Umudike	Early maturing, moderately suitable for intercropping, high yielding, suitable for food and industry and tolerance to drought.	48.4	Southern and Northern Guinea Savanna	2010
CR 41-10	NRCRI, Umudike	Very suitable for intercropping, early maturing, high yielding, suitable for food and industry and tolerance to acidic soils.	46.4	Southern and Northern Guinea Savanna	2010
TMS 01/0040	NRCRI, Umudike	Moderate branching that can smother weeds, early maturing, high yielding, suitable for food and industry.	51.7	Southern and Northern Guinea Savanna	2010
TMS 00/0203	NRCRI, Umudike	Suitable for smothering weeds in sole cropping, early maturing, high yielding, suitable for food and industry.	43.3	Southern and Northern Guinea Savanna	2010
IITA TMS 1011368	NRCRI, Umudike	High beta carotene, high yield, suitable for gari and fufu, suitable for high-quality cassava flour.	46.5	Humid Forest/Savanna Ecological Zones	2011
IITA TMS 1011412	NRCRI, Umudike	High beta carotene, high yielding, suitable for gari and fufu, broad adaptation.	59.1	Southern and Northern Guinea Savanna	2011
IITA TMS 1011371	NRCRI, Umudike	High beta carotene, suitable for gari and fufu, suitable for high-quality cassava flour.	39.3	Southern and Northern Guinea Savanna	2011
NR 03/0211	NRCRI, Umudike	Early maturing, high yielding, high starch yield, suitable for high-quality cassava flour.	42.5	Southern and Northern Guinea Savanna	2011
NR 03/0155	NRCRI, Umudike	Early maturing, high yielding, suitable for gari and fufu, tolerance to drought.	53.7	Southern and Northern Guinea Savanna	2011
CR 36-5	NRCRI, Umudike	High starch yield, high dry matter, erect plant type suitable for intercropping and dense population in plantations and suitable for gari and fufu	42	Southern and Northern Guinea Savanna	2012
IITA TMS I 982132	IITA, Ibadan, NRCRI, Umudike	High root yield, high dry matter, and moderate carotene content.	48.5	Rainforest and Southern Guinea Savanna	2012
IITA TMS I011206	IITA, Ibadan, NRCRI, Umudike	High root yield, high dry matter content, drought tolerance (leaf retention in dry season), and suitability for high quality cassava flour due to low fibre content and high starch of dry roots	53	Rainforest and Northern Guinea Savanna	2012
NR 07/0220	NRCRI, Umudike/IITA, Ibadan	High beta carotene content and high yielding.	36	Rainforest and Southern Guinea Savanna	2014
IITA TMS I 07/0593	IITA, Ibadan/NRCRI, Umudike	High carotene content and high yielding.	34	Rainforest and Southern Guinea Savanna	2014
IITA TMS I 07/0539	IITA, Ibadan/NRCRI, Umudike	High carotene content and high yielding.	32	Rainforest and Southern Guinea Savanna	2014

APPENDIX XI

The table below shows the yam varieties developed and released in Nigeria since 2009:

Variety Name	Developing Institute	Characteristics	Yield Potential (MT/Ha)	Year of Release
TDr 95/19158	NRCRI	High yielding, pests, and diseases tolerant, very good for yam, fufu, frying and boiling.	29.4	2009
TDr 89/02602	NRCRI	High yielding, pests, and diseases tolerant, very good for yam, fufu, frying and boiling.	31.5	2009
TDr 89/02660	NRCRI	High yielding, pests, and diseases tolerant, very good for yam, fufu, frying and boiling.	31	2009
TDa 00/00194	NRCRI	High yielding, pests, and diseases tolerant, good for pounded yam, frying, and boiling.	37.5	2009
TDa 00/00104	NRCRI	High yielding, pests, and diseases tolerant, good for pounded yam, frying, and boiling.	30	2009
TDa 00/00364	NRCRI	High yielding, good for Amala, pounded yam, frying, and boiling.	33.3	2010
TDr 95/19177	NRCRI	High yielding under dry season yam cropping system.	30	2010
TDr 89/02475	NRCRI	High yielding, pests, and diseases tolerant, very good for yam fufu, frying and boiling.	31	
TDr 98/00933	IITA, & NRCRI	High yielding.	39.8	2016
99/Amo/064	NRCRI	High yielding.	43.9	2016

APPENDIX XII

The table below shows the maize varieties developed and released in Nigeria since 2009:

Variety Name	Developing Institute	Characteristics	Yield Potential (MT/Ha)	Agro-ecological Zones	Year of Release
FARALOKUN	IAR&T	High level of lysine (3.67%) and Tryptophan (0.87%), earliness in maturity was admired by farmers.	4.0-4.6	Forest, derived Savanna and Savanna zones	2009
MAYOWA	IAR&T	High level of lysine (3.67%) and Tryptophan (0.87%). Earliness in maturity placed it at advantage especially dryer environment.	4.0- 4.96	Forest, derived Savanna and Savanna zones	2009
BR9943 DMRSR	IITA	Highly resistant to stem borers (both Sesamia calamistis and Eldana sacharina)	3-4	Forest zone	2009
BR9928 DMRSR	IITA	Highly resistant to stem borers (both Sesamia calamistis and Eldana sacharina)	3-4	Forest transition/Derived Savanna	2009
Ama TZBR-W	IITA	Highly resistant to stem borers (both Sesamia calamistis and Eldana sacharina)	3-4	Humid forest, Forest transition/Derived Savanna	2009
TZBR Eld 3-W	IITA	Highly resistant to stem borers (both Sesamia calamistis and Eldana sacharina).	3-4	Humid forest, Forest transition/Derived Savanna	2009
SAMMAZ 17	IAR	High yield, medium maturity and Striga tolerance.	5	Low land Tropics	2009
SAMMAZ 18	IAR	High yield, early maturity and Striga tolerance.	4.5	Low land Tropics	2009
SAMMAZ 19	IAR	High yield, drought and Striga tolerance.	5	Low land Tropics	2009
SAMMAZ 20	IITA	Highly tolerant to drought with resistance to streak and tolerance to low soil nitrogen.	3-4	Drought prone areas	2009
SAMMAZ 21	IITA	Highly tolerant to Striga hermonthica infestation.	1.5-2	Striga prone areas	2009
SAMMAZ 26	IITA	Highly tolerant to drought with resistance to streak and tolerance to low soil nitrogen.	3-4	All agroecological zones	2009
SAMMAZ 27	IITA	Drought tolerant and Striga resistant.	5.5	Low land Tropics	2009
SAMMAZ 28	IITA	Drought and Striga tolerant.	4	Low land Tropics	2009
SAMMAZ 29	IITA	Extra early maturing drought escaping and Striga tolerant.	4	Low land Tropics	2009
SAMMAZ 30	IITA	Highly tolerant to low soil nitrogen with resistance to streak.	3.5-4	Northern and Sudan Savanna	2009
SAMMAZ 31	IITA	Highly tolerant to low soil nitrogen with resistance to streak.	3.5-4	All agroecological zones	2009
SAMMAZ 22	IITA	Highly tolerant to drought with resistance to streak and tolerance to low soil nitrogen.	2-4	Northern Guinea Savanna	2009
SAMMAZ 23	IITA	Highly tolerant to drought with resistance to streak and tolerance to low soil nitrogen.	3-4	Northern Guinea Savanna	2009
SAMMAZ 24	IITA	Highly tolerant to drought with resistance to streak and tolerance to low soil nitrogen.	3-4	Northern Guinea Savanna	2009
SAMMAZ 25	IITA	Highly tolerant to drought with resistance to streak and tolerance to low soil nitrogen.	3-4	Northern Guinea Savanna	2009
Oba Super 3	IITA	High yield, more adapted to rain forest ecology, more amenable to manual harvesting and excellent husk cover which makes it less prone to ear rot.	7-8	Rainforest and low land Savanna ecologies	2009
Oba Super 4	IITA	More adapted to the rain forest ecology and high yield.	6-7	Rainforest and low land Savanna ecologies	2009
Oba Super 5	IITA	Highly prolific expressed in good yield, more tolerant to lodging, excellent plant and ear aspect, more suitably adapted to mechanized harvesting, shining, more attractive creamy-white seeds and drought tolerant.	8-9	Rainforest and low land Savanna ecologies	2009
Oba Super 6	IITA	High yield, drought tolerant, low soil nitrogen-efficient, excellent plant and ear aspect.	7-8	Rainforest and low land Savanna ecologies	2009

Oba Super 7	IITA	Highly Striga resistant, drought tolerant, low soil nitrogen efficient, supports low striga emergence, high yield potential, good for sole cropping and rotation with legumes (integrated striga control) and high starch content.	4	Rainforest and low land Savanna ecologies	2009
Oba Super 9	IITA	Striga resistant, supports low striga emergence and good for sole cropping and rotation with legumes (integrated striga control).	3.5	Rainforest and low land Savanna ecologies	2009
SAMMAZ 32	IITA	Extra early maturing, quality protein maize, good cob, and seed size, Striga resistant, drought escaping, and tolerant to maize streak virus disease.	4.3	Sudan Savanna and transition zone between Sudan and Northern Guinea savanna	2011
SAMMAZ 33	IITA	Extra early maturing, quality protein maize, good cob, and seed size, Striga resistant, drought tolerance, and tolerant to maize streak virus disease.	3.9	Sudan Savanna and transition zone between Sudan and Northern Guinea savanna	2011
SAMMAZ 34	IAR & IITA	Prolific cob bearing, good stay green, good quality fodder.	4.7	Sudan Savanna and transition zone between Sudan and Northern Guinea savanna	2011
SAMMAZ 35	IAR & IITA	Good grain quality, Resistant to Striga hermonthica.	4.5	Sudan Savanna and transition zone between Sudan and Guinea savanna	2011
SAMMAZ 36	IAR	Good stay green, Excellent husk cover.	5.3	Nigeria Savanna	2011
SAMMAZ 37	IITA & IAR	Good quality grains, Tolerance to maize streak virus disease, drought and striga infestation.	5.9	Nigeria Savanna	2011
Ife Maizehyb-1	IITA & IAR&T	High protein content (9- 12%), high yield, good seed quality.	5.6-6	Derived and Southern Guinea Savanna	2012
Ife Maizehyb-2	IITA & IAR&T	High yield, good seed quality and tolerance to root and stem lodging.	6.65	Forest and Southern Guinea Savanna	2012
Ife Maizehyb-3	IITA & IAR&T	High yield, good seed quality, high pro-vitamin A.	6.65	Forest and Southern Guinea Savanna	2012
Ife Maizehyb-4	IITA & IAR&T	High yield, good seed quality, high pro-vitamin A. and nitrogen use efficient.	6.65	Forest and Southern Guinea Savanna	2012
SNK2778	Monsanto, The Candel Company Limited, Nigeria	High yield, large grain use, tolerant to lodging and stem breakage.	8.4	Nigeria Savanna	2012
SAMMAZ 38	IITA & IAR	Intermediate level of provitamin A content (5.7µg/g), high yield potential.	6.4	Nigeria Savanna	2013
SAMMAZ 39	IITA & IAR	Intermediate level of provitamin A content (6.4µg/g), high yield potential.	6.8	Nigeria Savanna	2013
Ife Maizehyb-5	IITA, IAR&T, & IAR	Extra-early maturing, high grain yield, Striga resistant, drought and low soil nitrogen tolerant, high protein content.	5.6- 6	Forest and Savanna agro – ecologies	2013
Ife Maizehyb-6	IITA, IAR&T, & IAR	Extra-early maturing, high grain yield, Striga resistant, tolerant to drought and low soil nitrogen.	5-6	Nigeria Savanna	2013
SAMMAZ 40	IITA & IAR	High yield potential; Tolerant to drought and Striga hermonthica.	7.1	Nigeria Southern Guinea Savanna and Northern Guinea Savanna	2014
SC719	Seed Co West Africa, Abuja, IAR, IAR&T, & IITA	High yield, and large grain size.	12		2014

30Y87	Pioneer Overseas Corporation, USA	High yield, excellent stay green characteristics, uniform ear placement, good standability.	12	Forest, Forest transition, Southern Guinea, and Northern Guinea Savanna	2014
30F32	Pioneer Overseas Corporation, USA	High yield, resistant to root and stalk lodging.	9	Southern and Northern Guinea Savanna	2014
P48W01	IITA	Combined host plant resistance to Striga and tolerance to Metsulfuron methyl (MSM) for Striga control.	5	Southern and Northern Guinea Savanna	2014
P48W03	IITA	Prolific, combines host plant resistance to striga and tolerance to Metsulfuron methyl (MSM) for striga control.	4.5	Northern Guinea Savanna and Sudan Savanna	2014
SAMMAZ 41	IITA & IAR	Early maturing, high grain yield, highly stable and low soil nitrogen tolerant.	7.8	Northern Guinea Savanna and Sudan Savanna	2014
SAMMAZ 42	IITA & IAR	Early maturing, high grain yield and low soil nitrogen tolerant.	7.8	Northern Guinea and Sudan Savanna	2014
SAMMAZ 43	IITA & IAR	Intermediate levels of provitamin A content (8.4ug/g) and high grain yield.	9.9	Northern and Southern Guinea Savanna ecologies	2015
SAMMAZ 44	IITA & IAR	Intermediate levels of provitamin A content (8.8ug/g) and high grain yield.	9.7	Northern and Southern Guinea Savanna ecologies	2015
SAMMAZ 45	IITA & IAR	Resistant to aflatoxin and high grain yield.	6.2	Northern and Southern Guinea Savanna ecologies	2015
Ife Maize hyb08	IAR&T	High yielding.	8.6	Forest and Derived Savanna agroecology	2015
Ife Maize hyb09	IAR&T	High grain yield, prolific maize cobs.	12.91	Forest and Derived Savanna agroecology	2015
SC651	IITA	Tolerant to drought and Striga hermonthica, high yield potential and good husk cover.	9.7	Guinea Savannah	2015
DK234	Monsanto International SARL	High grain yield, good stay-green characteristic and standability, and tolerant to Striga hermonthica.	13.2	Southern and Northern Guinea Savanna ecologies	2016
DK777	Monsanto International SARL	Stable and high grain yield, good stay-green characteristic and tolerance to Striga hermonthica.	10.9	Forest, Southern and Northern Guinea Savanna ecologies	2016
DK818	Monsanto International SARL	Stable and high grain yield, and tolerance to Striga hermonthica.	10	Southern and Northern Guinea Savanna ecologies	2016
DK920	Monsanto International SARL	High grain yield, prolific, tolerance to Striga hermonthica	10.7	Southern and Northern Guinea Savanna ecologies	2016
Oba Super 11	IITA, & Premier Seed Nig. Ltd.	Striga and drought tolerance and high yield.	9.6	Southern and Northern Guinea Savanna ecologies	2016
Oba Super 13	IITA, & Premier Seed Nig. Ltd.	Striga and drought tolerance and high yield.	9.7	Southern and Northern Guinea Savanna ecologies	2016
SAMMAZ 46	IITA & IAR	Early maturity, high grain yield, tolerance to drought, Striga hermonthica and low soil nitrogen.	9.6	Northern Guinea and Sudan Savanna ecologies	2016
SAMMAZ 47	IITA & IAR	Early maturity, high grain yield, tolerance to drought, Striga hermonthica and low soil nitrogen.	10.3	Northern Guinea and Sudan Savanna ecologies	2016

SAMMAZ 48	IITA & IAR	Early maturity, stable and high grain yield, tolerance to drought and Striga hermonthica.	7.8	Northern Guinea and Sudan Savanna ecologies	2016
SAMMAZ 49	IITA & IAR	Intermediate levels of provitamin A content (11.3µg/g)	7.8	Northern Guinea and Sudan Savanna ecologies	2016
SAMMAZ 50	IITA, & IAR	Tolerance to drought and Striga hermonthica	9.3	Southern and Northern Guinea Savanna	2016
SAMMAZ 51	IITA, & IAR	High grain yield, tolerance to drought and Striga hermonthica	8.5	Southern and Northern Guinea Savanna	2016
SAMMAZ 52	IITA, & IAR	Intermediate levels of provitamin A content (9.8µg/g).	6	Northern Guinea and Sudan Savanna ecologies	2017
SAMMAZ 53	IITA, & IAR	Extra-early maturity, high grain yield, tolerance to drought and Striga hermonthica.	7.6	Northern Guinea and Sudan Savanna ecologies	2017
SAMMAZ 54	IITA, & IAR	Extra-early maturity, high grain yield, tolerance to drought and Striga hermonthica.	7.2	Northern Guinea and Sudan Savanna Ecologies	2017
SC612	IITA & Seed Co	Tolerant to drought, high yield, and good husk cover.	9	Guinea Savannah	2017
SC649	Seed Co, Kaduna, Nigeria	High yield, good husk cover, easy to produce.	8.1	Guinea Savannah	2017
DK390	Monsanto Int. & IAR	High grain yield and good standability.	9.4	Southern and Northern Guinea Savanna ecologies	2017
DK7508	Monsanto Int. & IAR	High grain yield.	9.8	Southern and Northern Guinea Savanna ecologies	2017
P3966W	Pioneer Overseas Corporation, USA	High grain yield, good standability.	8.9	Forest, forest transition, southern and northern Guinea savannah	2018
P4063W	Pioneer Overseas Corporation, USA	Resistant to lodging, high grain yield, big kernels, and excellent husk cover	8.1	Forest, forest transition, southern and northern Guinea savannah	2018
P4226	Pioneer Overseas Corporation, USA	High grain yield, excellent stay-green characteristics, excellent husk cover and good standability.	8	Forest, forest transition, southern and northern Guinea savannah	2018
WE3205	Monsanto International SARL	Tolerant to drought, early maturing, and high grain yield.	7.9	Southern, Northern and Sudan savannah	2018
DKB350	Monsanto International SARL	Tolerant to drought and high grain yield.	9.4	Southern and Northern Guinea savannah	2018
AMANA-1	IITA	High grain yield.	9.1	Mid-altitude	2018
AMANA-2	IITA	High grain yield and prolific.	7.7	Mid-altitude	2018

APPENDIX XIII

The table below shows the rice varieties developed and released in Nigeria since 2009:

Variety Name	Developing Institute	Characteristics	Yield Potential (MT/Ha)	Agro-ecological Zones	Year of Release
FARO 58	Africa Rice Centre and NCRI	Earliness, high grain yield, good cooking quality, tolerance to lodging	5	Northern and Southern Guinea Savanna, Sudan Savanna	2011
FARO 59	Africa Rice Centre and NCRI	Earliness, golden grain colour, weed competitiveness and tolerance to lodging.	5	Northern and Southern Guinea Savanna, Sudan Savanna	2011
FARO 60	Africa Rice Centre and NCRI	High yielding, long and slender grains and tolerant to iron toxicity.	8	Forest Transition/Derived Savanna	2011
FARO 61	Africa Rice Centre and NCRI	Earliness, high yielding, tolerant to anaerobic germination (ability to germinate under water).	7	Forest Transition/Derived Savanna	2011
FARO 62	NCRI, Badeggi	High yielding and tolerant to drought.	4	Forest Transition/Derived Savanna	2011
FUNAABOR-1	FUNAAB (IFSERAR) & NCRI, Badeggi	Good yield, gold-coloured grains with red strips, very high swelling capacity and good nutrient acceptable, excellent stay green attribute, high ratooning ability.	2.7	Forest Transition/Derived Savanna	2011
FUNAABOR-2	FUNAAB (IFSERAR) & NCRI, Badeggi	Good nutrient, yield, pure white, smooth, long, sweet grains, acceptable.	2.5	Forest Transition/Derived Savanna	2011
UPIA 1	University of Port Harcourt, International Rice Research Institute, AGRA	Early maturity, high yield, long slender grains, tolerant to iron toxicity and African rice gall midge.	6.6	Forest Transition/Derived Savanna	2013
UPIA 2	University of Port Harcourt, International Rice Research Institute, AGRA	High yield, long slender grains, tolerant to iron toxicity and African rice gall midge.	8	Forest Transition/Derived Savanna	2013
UPIA 3	University of Port Harcourt, International Rice Research Institute, AGRA	Early maturity, high yield, long slender grains and tolerant to iron toxicity.	7	Forest Transition/Derived Savanna	2013
FARO 63	Africa Rice Centre and NCRI	Early maturity and high yielding.	6.2	Rainfed upland	2014
FARO 64	Africa Rice Centre and NCRI	Early maturing, high yielding, and drought tolerance	5.2	Rainfed upland	2015
FARO 65	Africa Rice Centre and NCRI	Early maturing, high yielding, and drought tolerance.	6.4	Rainfed upland	2015
FARO 66	Africa Rice Centre and NCRI	Submergence tolerant, high yielding, long and medium slender grains and moderately tolerant to iron toxicity.	6.7	Lowland	2017
FARO 67	Africa Rice Centre and NCRI	Submergence tolerant, high yielding, long and slender grains and moderately tolerant to iron toxicity.	6.7	Lowland	2017
GAWAL R1	Green Agriculture West Africa Limited	High yielding, and tolerance to blast disease	10.4	Lowland rainfed and irrigated ecologies	2017

APPENDIX XIV

The table below shows the soybean varieties developed and released in Nigeria since 2009:

Variety Name	Developing Institute	Characteristics	Yield Potential (MT/Ha)	Agro-ecological Zones	Year of Release
TGx 1987-10F	IITA & NCRI	Early maturing, high promiscuous, highly resistant to rust, cercospora leaf spot and bacterial pustule.	1.5- 2	Forest Transition/Derived Savanna and Northern Guinea Savanna	2010
TGx 1987-62F	IITA & NCRI	Early maturing, high promiscuous nodulation, highly resistant to rust, cercospora leaf spot and bacterial pustule.	2.1	Forest Transition/Derived Savanna and Northern Guinea Savanna	2010
TGx 1951-3F	IITA & NCRI	Low shattering, tolerant to rust, cercospora leaf spot and bacterial pustule and poor soils.	2.5	Guinea and Sudan Savanna	2014
NCRISOY 1	IITA & NCRI	Extra early maturing, promiscuous nodulation, resistant to rust, cercospora leaf spot and bacteria pustule.	2.5	Guinea and Sudan Savanna	2014
NCRISOY 2	IITA & NCRI	High yield, promiscuous nodulation, resistant to rust, cercospora leaf spot.	3	Guinea and Sudan Savanna	2014
SC-SL01	Seed Co Ltd., Harare, Zimbabwe	Rust tolerance, earliness, large seed size, and high pod clearance.	3.1	Guinea Savanna	2018