

DIGITAL AGRICULTURE IN NIGERIA: OPPORTUNITIES, CHALLENGES AND POLICY RECOMMENDATIONS

MARCH 2025



The Digital Advisory Support Services for Accelerated Rural Transformation (DAS) Program is a facility funded by a grant from the International Fund for Agricultural Development (IFAD). The DAS consortium of partners includes Development Gateway: an IREX Venture, TechChange, and JengaLab.

This document has been produced with the financial assistance of IFAD. The findings, opinions, interpretations, and conclusions expressed in this publication are those of the authors and do not necessarily reflect the views of IFAD, its Executive Board, its Members, or any Member State they represent. IFAD does not guarantee the accuracy of the data included in this work. The boundaries, colours, denominations, and other information shown on any map in this work do not imply any judgment on the part of IFAD concerning the legal status of any territory or the endorsement or acceptance of such boundaries.

Authors:

Development Gateway: An IREX Venture

ABBREVIATIONS

APP	Green Alternative - Agricultural Production Policy	MSME	Micro, small and medium enterprise
CBN	Central Bank of Nigeria	NITDA	National Information Technology Development Agency
COSOP	Country Strategic Opportunity Program	TAM	Total Addressable Market
DAS	Digital Advisory Support Services for Accelerated Rural Transformation	VCDP	Value Chain Development Programme
DFS	Digital Financial Services	VCN	Value Chain North
FAO	Food and Agriculture Organization		
FGN	Federal Government of Nigeria		
ICT4D	Information and Communications Technology for Development		
IFAD	International Fund for Agricultural Development		
IoT	Internet of Things		
ITU	Interationational Telecommunications Union		
IVR	Interactive Voice Response		
KII	Key Information Interview		
LIFE-ND	Livelihood Improvement Family Enterprises Project for the Niger Delta		
MDAs	Ministries, Departments, Agencies		

TABLE OF CONTENTS

	3
Table of Contents	4
Introduction and Background	5
Nigeria Overview	5
Key information on Nigeria's agricultural sector	6
The Digital Economy in Nigeria	7
ICT4D IFAD Business Models	13
IFAD-financed Programs	13
The Value Chain Development Programme	13
LIFE-ND	15
Barriers to digital tool adoption in Nigeria	16
Recommendations	17
Annex 1: Digital Agriculture Solutions	22

INTRODUCTION AND BACKGROUND

Nigeria's agricultural sector, despite its vast potential, faces numerous challenges that hinder its productivity and efficiency. Integrating digital tools has emerged as a transformative solution to enhance agriculture development and productivity. **This case study examines the Value Chain Development Programme (VCDP) and the Livelihood Improvement Family Enterprises Project for the Niger Delta (LIFE-ND) within Nigeria.** It offers recommendations to leverage digital tools for agricultural advancement through capacity building, technical assistance, strategic partnerships, and low-tech solutions to assist in agriculture development.

As part of the International Fund for Agricultural Development's (IFAD) ongoing commitment to sustainable agricultural transformation, IFAD acknowledges the immense potential that digital innovations hold for modernizing the agricultural sector. While IFAD Nigeria country programs have embraced ICT4D to some extent, continued efforts to expand its adoption and integration are needed.

In Nigeria, a nation with abundant agrarian promise yet frequently constrained by traditional challenges, the infusion of digital tools can serve as a crucial catalyst. Aligned with national policies and strategies, the IFAD country program is eager to scale up the adoption and integration of ICT4D to drive a more profound agricultural transformation and substantially improve the livelihoods of smallholder farmers. Nigeria's digital agriculture ecosystem was assessed to grasp the current landscape, pinpoint opportunities, and facilitate targeted interventions.

A country-wide ecosystem assessment was conducted through the Digital Advisory Support Services for Accelerated Rural Transformation (DAS) Program, a demand-based facility funded through a grant from IFAD.

NIGERIA OVERVIEW

With a population of over 200 million people, Nigeria is the most populous country in Africa and the largest economy in the region. Like other lower-middle-income countries, the country faces significant poverty and inequality challenges. Nigeria is home to the largest number of extremely poor people in the world, based on a poverty threshold of \$1.90 a day, the World Poverty Clock's model estimates over 50 percent of the country's extremely poor live in rural areas. The majority of rural poor are women¹. Of the Nigerian farming population, 70 percent are poor smallholder farmers with limited ability to cope with shocks particularly related to climate change; 44.1 percent suffer from food insecurity; 12.6 percent are malnourished; and 37 percent of children under 5 years of age are stunted.² To feed its growing population, Nigeria has reached a critical level of food importation, spending over US\$6 billion a year on agricultural imports.³ Disruption of farming activities and disturbances in the food supply caused by COVID-19 are increasingly threatening the lives of about 100 million rural Nigerians and have contributed to perpetuating poverty⁴.

¹ Nigeria: World Poverty Clock.

² FAO, 2019: <http://www.fao.org/faostat/en/#data/FS>.

³ CBN and National Bureau of Statistics, Annual Report, 2013.

⁴ [IMF Food Insecurity in Nigeria: Food Supply Matters: Nigeria](#).

In 2021, Nigeria's economy experienced growth of 3.6%, a significant improvement from the 1.8% contraction observed in 2020.⁵ This growth was primarily driven by a 4.4% expansion in the non-oil sector, while the oil sector contracted by 8.3%.⁶ Agriculture (2.1%) and services (5.6%) were the main contributors to the growth of the non-oil sector⁷. Public and private consumption also played a role in driving GDP growth. Per capita income increased by 1.0% in 2021⁸.

Despite economic improvements, poverty and unemployment rates remained high, with no significant change from 2020. The poverty rate stood at around 40%, while the unemployment rate remained at approximately 33.3% in 2021⁹.

KEY INFORMATION ON NIGERIA'S AGRICULTURAL SECTOR

- The share of agriculture in Nigeria's total export earnings remains small compared to crude oil exports. For instance, in 2019, agriculture accounted for less than 2% of total exports relative to crude oil (76.5%)¹⁰.
- Nigeria's major agricultural imports include wheat, sugar, fish, and milk, while the main agricultural exports include sesame seeds, cashew nuts, cocoa beans, ginger, frozen shrimp, and cotton¹¹.
- Sesame, cashew nuts, and cocoa account for over half of the nation's agricultural exports, while wheat dominates agricultural imports¹².
- Agricultural exports have surged to a five-year high in 2022¹³.
- Nigeria's agricultural imports rose by 12.7% from N851.6 billion to N959.5 billion during the same period, the highest value ever recorded in the country¹⁴.
- Nigeria remains a net food importer — the agricultural trade deficit has widened, with imports exceeding exports by N689.7 billion in 2019 compared to N549.3 billion in 2018¹⁵.

⁵ [AFDB African Economic Outlook 2022](#)

⁶ Ibid

⁷ Ibid

⁸ Ibid

⁹ [National Bureau of Statistics 2019 Poverty and Inequality in Nigeria](#)

¹⁰ National Bureau of Statistics: Foreign Trade in Goods Statistics

¹¹ Ibid

¹² Ibid

¹³ Ibid

¹⁴ Ibid

¹⁵ PwC: Current State of Nigeria Agriculture and Agribusiness Sector

~22%

The share of agricultural contribution to GDP as of Q1 2020 stood at approximately 22%.

>80%

More than 70% of Nigeria's farmers are smallholder farmers (SHFs). These numbers accounts for 90% of Nigeria's agricultural produce.

36%

The agricultural sector remains the largest employer in Nigeria, employing more than 36% of the labor force.

0.27hp hectare

Nigeria's tractor density is put at 0.27 hp/ hectare which is far below the FAO's recommended tractor density of 1.5 hp/ hectare.

N40bn

Only about N40 billion was earmarked by the government for agricultural research and development (R&D) in 2019.

1.8%

Agriculture budget represents 1.8% (or N183 billion) of the total 2020 budget size. This significantly falls short of the 10% specified in the Maputo Declaration.

THE DIGITAL ECONOMY IN NIGERIA

At its core, the digital economy encompasses an array of economic activities driven by digital technologies, encompassing everything from e-commerce platforms and electronic banking to digital content creation and technology-based services¹⁶. This vast expanse of the economy thrives on digitized information and the internet to operate, innovate, and generate value. One of the dynamic constituents of the digital economy, often overlooked yet holding significant potential, is digital agriculture¹⁷.

Digital agriculture uses new and advanced technologies integrated into agricultural practices to enhance productivity, efficiency, and sustainability¹⁸. From precision farming that uses drones and IoT devices to monitor and manage crops to digital platforms that connect farmers directly to markets and mobile applications providing real-time weather and crop health information, digital agriculture is transforming the traditional agricultural landscape¹⁹. As it integrates more into the broader digital economy, it propels agricultural practices into the 21st century. It contributes to economic diversification and growth, linking rural and urban sectors and bridging gaps in information, market access, and resources²⁰. Thus, digital agriculture is an evolution of farming practices and a fundamental pillar of the burgeoning digital economy.

Nigeria's digital economy has experienced significant growth in recent years, driven by increased access to digital infrastructure, government initiatives promoting digital literacy and entrepreneurship, and a supportive regulatory environment.

¹⁶ Tapscott, D. (1997). The digital economy: Promise and peril in the age of networked intelligence.

¹⁷ Duncan, Emily. 2018. An Exploration of How the Relationship between Farmers and Retailers Influences Precision Agriculture Adoption

¹⁸ Bronson, K., & Knezevic, I. (2016). Big Data in food and agriculture. *Big Data & Society*

¹⁹ Conceptual model of a future farm management information system. *Computers and electronics in agriculture*, 72(1), 37-47.

²⁰ FAO, 2021 [New digital agriculture opportunities](#)

Digital access in Nigeria has grown, with over 157 million active Internet subscriptions and over 227 million active mobile phone lines as of February 2023²¹. Mobile wireless Internet access is limited by coverage, the number of users per site, and the scarcity of devices with 4G capability. The government has also launched initiatives to increase access to digital infrastructure in rural areas, including the [National Broadband Plan](#), [Accelerated Mobile Phone Expansion Program](#), and the [Rural Broadband Initiative](#).

The government has launched several initiatives to support digital literacy, including the [Digital Nigeria program](#), which aims to train over 10 million Nigerians in digital skills. In addition, several private sector players, such as Google and Microsoft, have launched initiatives like the [African Transformation Office](#) and [Digital Skills for Africa](#) to promote digital literacy and skills development in Nigeria.

Nigeria's digital innovation and entrepreneurship ecosystem is also growing. Nigeria has Africa's most prominent tech hub cluster, with several startups and technology hubs in operation²². According to a report by [Partech Ventures](#), Nigeria is the leading destination for startup investment in Africa, attracting over \$1.2 billion in venture capital funding in 2022.²³

Nigeria's regulatory environment also supports the digital economy, with the government launching several initiatives to promote digital innovation and entrepreneurship. These initiatives include establishing the [Nigerian Startup Act](#) and the [National Digital Innovation and Entrepreneurship Centre](#).

Nigeria faces significant challenges in achieving widespread broadband usage, especially in rural areas²⁴. Infrastructure limitations and market failures hinder progress. High costs, such as right-of-way fees, damage to existing fiber infrastructure, and unreliable electricity supply, make it economically unviable to provide services independently.²⁵ This lack of profitability discourages operators and internet service providers (ISPs) from deploying infrastructure in rural areas. As a result, network operators prioritize profitable regions like major urban areas and intercity routes, leaving those outside these areas at a disadvantage.²⁶ Additionally, operators' declining revenues due to competition and the inability to generate significant income from data, like in more developed markets, result in reduced investment in infrastructure expansion.²⁷ The macroeconomic situation further compounds these challenges, leading operators to slow down or postpone their investment plans.

²¹ Nigerian Communications Commission:

<https://ncc.gov.ng/statistics-reports/industry-overview#view-graphs-tables-5>

²² Startup Blink: <https://www.startupblink.com/startupecosystemreport>

²³ Partech Ventures:

<https://partechpartners.com/press-room/presenting-2022-partech-africa-report-resilient-african-tech-ecosystem-still-growing-65-billion-raised-2022/>

²⁴ World Bank Nigeria Digital Economy Diagnostic Report

²⁵ Ibid

²⁶ Ibid

²⁷ Ibid

Digital Infrastructure

First Mile: The infrastructure connecting Nigeria to international and inter-continental networks is well-equipped, with six submarine cables and 55 licensed satellite operators. These connections enable access to global destinations and the internet. The submarine cable segment has abundant capacity, with over 40Tbps available in Lagos²⁸. However, due to limitations in other parts of the network, only a small percentage of the population utilizes this capacity. Improving interconnection between the cables will help prevent disruptions and ensure reliable internet service²⁹.

National Backbone (National Backbone/Core/Distribution Network) and Middle Mile: The middle mile in Nigeria includes the National backbone, Core, and Distribution Network links. These networks are owned by various operators, including Mobile Network Operators (MNOs), National long-distance Operators (NLDOs), and government agencies. The total distance of fiber-optic and microwave networks deployed in the country is approximately 54,000 kilometers³⁰. However, there need to be more routes across service providers.³¹

Around 39% of the population has access to fiber networks within 5 kilometers. The reach varies, with Lagos State having the highest reach at 85% and Jigawa State having the lowest at 12%³². The connection rate for last-mile Fibre-to-the-Home (FTTx) and Fibre-to-the-Tower (FTTT) is low compared to other African countries.³³

Last Mile: Last mile connectivity in Nigeria is largely mobile, with comparatively lower investments in fixed lines infrastructure within the past two decades. Mobile coverage in Nigeria has expanded significantly with the introduction of Digital Mobile Licenses (DML). These licenses enabled operators to deploy 2G technology, providing voice services to over 89% of the population³⁴. The demand for internet access has led to the growth of 3G services, covering approximately 75% of the population³⁵.

Deployment of 4G networks has been limited to major urban areas in the past three years, reaching around 37% of Nigeria's population³⁶. However, beyond these urban areas and state capitals, 4G and 5G coverage remain sparse. It's worth noting that while 3G coverage is available in most areas, each region is typically served by only one operator³⁷.

²⁸ Nigerian National Broadband Plan 2020 – 2025

²⁹ Ibid

³⁰ Ibid

³¹ Ibid

³² Ibid

³³ Ibid

³⁴ Ibid

³⁵ Ibid

³⁶ Ibid

³⁷ Ibid

Fixed broadband penetration in Nigeria is very low, with a household penetration rate of 0.04% at the end of 2018, below the African regional average (0.6%) and well below the world average (13.6%)³⁸.

Fixed broadband remains a “niche” service used by public institutions, some businesses, and a few privileged households³⁹. Therefore, there are important digital divides in fixed broadband along gender and urban-rural lines.

There is a significant digital gap in mobile broadband access in Nigeria. Approximately 20% of Nigerians own a smartphone, 44.8% own a feature phone, and 32.2% own a basic phone⁴⁰. Men are more likely to own a smartphone, while women are more likely to own a feature phone or basic phone.⁴¹

Quality of Service (QoS) issues continue to exist in Nigeria. Despite the significant growth and competition among operators, there are still problems with poor quality of service and network congestion. Limited coverage and low network quality, including slow download speeds, often lead subscribers to own multiple SIM cards⁴². At least half of mobile subscribers in the country possess more than one SIM card⁴³.

50% of those who were not connected to the Internet mentioned the affordability of devices as the main reason⁴⁴. Over 25% cited lack of electricity, and more than 20% mentioned insufficient mobile coverage⁴⁵. A survey of 2000 smallholder farmers revealed that 77% use basic phones without Internet capability, 88% have never used the Internet for business purposes, and 49% do not use cell phones and SMS services for business⁴⁶.

Electricity

In 2019, 55.4% of the population in Nigeria had access to electricity. However, in rural areas, only 25.6% of people had access to a centralized power source, 66% of households were connected to the

³⁸ ITU Report 2018

³⁹ Gillwald, A and Mothobi, O (2018) *The State of ICT in 10 African countries: a demand side analysis with supply side insights*

⁴⁰ Ibid.

⁴¹ Ibid

⁴² Ibid

⁴³ [Nigeria: The State of ICT Report 2018](#)

⁴⁴ Ibid

⁴⁵ Gillwald, A and Mothobi, O (2018) *The State of ICT in 10 African countries: a demand side analysis with supply side insights*

⁴⁶ Anderson J., Marita C., Musiime D., & Thiam M. 2017. 'National Survey and Segmentation of Smallholder Households in Nigeria. Understanding Their Demand for Financial, Agricultural, and Digital Solutions'.

<https://www.cgap.org/research/publication/national-survey-and-segmentation-smallholder-households-nigeria>.

main electricity grid, 33.1% had no electricity connection, 11.4% relied on generators, and less than 1% had access to solar power⁴⁷.

Digital e-Government Platforms

Adopting e-government services in Nigeria is limited to just 2% of citizens⁴⁸. Interviews surfaced several factors contributing to this low usage:

- Limited access: Mobile technology, the primary means of access in Nigeria, lacks sufficient data services, particularly in rural areas. This digital divide hinders many citizens from engaging with e-government services.
- Low awareness: There is still a lack of awareness among the population regarding the available platforms and the range of services the government offers. This is especially true for those below the poverty line, who often have minimal participation in the digital economy.
- Lack of confidence: Many Nigerians lack trust in online services, particularly regarding financial transactions, due to concerns about cyber-security and weak data and privacy protection policies.
- Infrastructure challenges: Limited bandwidth and inadequate last-mile services to homes create difficulties in accessing e-government services regularly and sustainably.
- Quality of service: The persistently poor quality of service has been a significant issue, discouraging people from engaging with e-government platforms and accessing online resources more seriously.

Digital Agriculture Solutions in Nigeria

The vast majority of Nigeria's digital agriculture startups are e-commerce platforms that connect producers, processors, and marketers with buyers, large-scale or small-scale, and then fintech services. The two types of solutions account for approximately 65% (n=23) of the digital agriculture startup market, followed by AI/IoT at 13%, Farm and supply chain management at 8.7%, Information and knowledge sharing at 4.3%, and others at 8.7%.⁴⁹ A list of digital agriculture solutions can be found in Annex 1.

⁴⁷ The state of ICT in Nigeria 2018

⁴⁸ Speech EVC Nigeria Communications Commission 2022 e-Government summit

⁴⁹ [Disrupt Africa: The Nigerian Startup Ecosystem Report](#)

IFAD-FINANCED PROGRAMS

THE VALUE CHAIN DEVELOPMENT PROGRAMME

Overview: Co-funded by the International Fund for Agricultural Development (IFAD), VCDP aims to improve the incomes and food security of poor rural households by enhancing the production, processing, and marketing of rice and cassava.

Implementation: Initially launched in six states and later expanded to nine due to its success, VCDP focuses on agricultural market development, smallholder productivity enhancement, and program management and coordination.

The Value Chain Development Programme (VCDP) is a six-year program of the Government of Nigeria funded by the IFAD. The program aims to improve poor rural households' incomes and food security by producing, processing, and marketing rice and cassava sustainably. VCDP was originally implemented in six states Anambra, Benue, Ebonyi, Ogun, Niger, and Taraba. As a result of the program's success, VCDP received additional finance for expansion into three states, Kogi, Nasarawa, and Enugu, making a total of 9 participating states.

The program, which is domiciled in the Federal Ministry of Agriculture and Rural Development, is implemented through the following components:

- Agricultural Market Development, which includes support to value addition and market linkages and support to market infrastructure;
- Smallholder Productivity Enhancement, which includes support to farmers' organization and support to smallholder production; and
- Programme Management and Coordination.

VCDP is well anchored in the Nigerian government's vision for agricultural transformation through a commodity value chain approach, emphasizing productivity and market access for rice and cassava smallholder farmers⁵⁰.

The tools listed below are used in the VCDP program. The assessment findings suggest that VCDP beneficiaries want digital solutions that enhance production. According to a beneficiary, there is a disproportionate emphasis on deploying digital solutions in other aspects of the program, like processing and marketing, rather than production.

⁵⁰ [President's report - Value Chain Development Programme](#)

Tool	Description	Addresses	Adoption	Accessibility
VCDP Agriculture Market Information System (AMIS)	Provides timely and accurate information on agricultural markets. It is designed to help farmers, traders, processors, and other stakeholders make informed decisions by providing relevant information on prices, supply and demand, market trends, and other market-related data.	Increase in productivity, climate resilience, and market benefits.	Still in the pilot phase, project has only been rolled out to about 200 beneficiaries. Disaggregated information on beneficiary states was not provided.	Browser-based and accessible through an internet-enabled mobile device or laptop.
Crops2Cash	<p>Offers beneficiaries two core products, Cash Card and Supply Base. Cash Card is an Android-based digital ecosystem for smallholder farmers that enables farmers to receive digital payments and build financial identities. Farmers use mobile devices to onboard in 2 minutes to access banking and insurance services, plus digital payment identity verification, which works together to determine a farmer's creditworthiness. Farmers can build their credit histories, receive payments, and take advantage of other financial benefits on the Cash Card platform.</p> <p>Supply Base helps agro-processors manage their supply relationships with farmers and suppliers. The digitized system processes payments from agro-processors to suppliers quickly. Users can leverage the platform's analytics features to track loan repayments, streamline product quality, monitor delivery, and make data-driven decisions.</p>	Financial inclusion	Still in the planning/pilot phase and only for Niger State.	App-based and accessible through an internet-enabled mobile device.

LIFE-ND

The Livelihood Improvement Family Enterprises Project for the Niger Delta (LIFE-ND) is a project of the Federal Government of Nigeria (FGN) designed in collaboration with the International Fund for Agricultural Development (IFAD) and the Niger Delta Development Commission (NDDC). The project is implemented in 9 states: Abia, Bayelsa, Cross River, Delta, Edo & Ondo NDDC States: Akwa Ibom, Imo & Rivers, and has a focus on youth and women in rural and suburban communities. LIFE-ND promotes community-based on-farm and off-farm business activities along key agricultural value chains as a job and wealth creation mechanism amongst unemployed and underemployed youths and women-headed households.

The LIFE-ND Project adopts an incubator model at the community level of the Local Government, targeting core commodities of comparative advantage in such communities. LIFE-ND community beneficiaries are identified, trained, and supported in different segments of Agriculture along the entire value chain. This support includes access to affordable agricultural inputs for sustainable production, agro-processing & packaging, transportation, and a link to competitive financing and markets. The LIFE Project ensures a robust production-to-marketing system that reduces food wastage and increases farm earnings for rural families⁵¹.

The tools listed below are part of the LIFE-ND program.

Tool	Description	Addresses	Adoption	Accessibility
Parkway Financial Technology	A digital financial payment system for beneficiaries to provide access to a range of financial services such as POS, Mobile Money, and Debit cards which have traditionally been out of reach to some. These systems will allow farmers to receive payments digitally, which is faster, more secure, and more convenient than traditional cash-based payments. The solution will enable farmers to build a financial identity, which can help them access credit, insurance, and other financial services.	Financial inclusion	Still in development	App-based and accessible through an internet-enabled mobile device
Digitize Africa Projects and Innovation Growth Hub	Train farmers to use technology to improve their agribusiness, increase productivity, and enhance access to markets and information. This training can include teaching farmers how to use mobile applications, online marketplaces, and digital payment systems.	Increase in productivity and market benefits	N/A	N/A

ICT4D BUSINESS MODELS USED

IFAD-financed programs have generally used two business models to deploy digital agriculture solutions to their beneficiaries.

1. **Procurement and customization of procured solutions** are the first approaches used with the VCDP Agriculture Market Information System.
2. **A partnership model** involving partnering with other companies or organizations to provide digital agriculture solutions to farmers has also been employed as a second. The partnership model approach has helped solution providers leverage IFAD's existing networks and expertise to expand the reach of digital solutions. This model can be seen in collaborations with Nimet and private sector solution providers like Parkway Financial Technology within LIFE-ND.

⁵¹ [President's report - Livelihood Improvement Family Enterprises Project for the Niger Delta](#)

The table below shows some of the digital agriculture solutions created by IFAD. In the next section, we dive deeper into two IFAD-funded programs and their associated tools.

Tool	Description	Addresses	Adoption	Accessibility
Profiling platform	Collects data about beneficiaries to provide insights into their personal information, communication, farm details, field information, crop information, and support received to create a comprehensive profile of smallholder farmers for targeted support and tracking by IFAD-funded programs	N/A	Across all programs, states, and beneficiaries.	Browser-based and accessible through an internet-enabled mobile device or laptop
Mini-weather station	Enables farmers to collect and monitor weather data in real-time. They're distributed in various states, providing information about weather conditions such as temperature, humidity, rainfall, and wind speed. Farmers can access data collected from the station in real-time through their devices.	Increases in productivity and climate resilience	Across all programs, states, and mainly used by lead farmers	It requires a handheld device, but the information is shared with other farmers through WhatsApp requiring a mobile phone with internet access.
Nimet	Provides climate data to beneficiaries and for calibration of weather stations by providing historical context for the weather conditions in a particular location. Comparing the readings from a weather station to the corresponding climate data makes it possible to identify any discrepancies or errors in the measurements. It helps ensure that weather stations provide accurate and reliable data, which is essential for various applications such as forecasting, research, and agriculture.	Increases in productivity and climate resilience	Across all programs, states, and beneficiaries	Information is shared over WhatsApp, requiring a mobile phone with internet access.

BARRIERS TO DIGITAL TOOL ADOPTION IN NIGERIA

The barriers listed below were extracted from the findings from the assessment and includes the beneficiaries of the LIFE-ND and VCDP programs. These findings provide important insights into digital tool adoption in agriculture.

1. **Poor internet infrastructure is a significant challenge for rural beneficiaries.** Many rural areas lack basic internet connectivity, making it difficult for farmers to access information,

- connect with buyers, and access digital agricultural services. This hinders the adoption of digital technologies in agriculture.
2. Over 75% of the beneficiaries interviewed expressed concerns that most smallholder farmers (non-beneficiaries) in their communities lack the **digital literacy** to use digital agriculture effectively. Many farmers are largely unaware of the potential benefits of digital agriculture and how digital skills can positively impact their farming practices. The lack of awareness stems from various factors, including limited access to information, inadequate training opportunities, and a lack of exposure to digital technologies.
 3. **The lack of reliable electricity makes it difficult for farmers to use digital technologies** such as smartphones, computers, and other internet-enabled devices for digital agriculture.
 4. For all beneficiaries interviewed, **WhatsApp is an important tool for digital agriculture**. Farmers and agricultural stakeholders in IFAD-financed programs use WhatsApp to connect, share information, and access resources to help them improve their farming practices and increase their yields.
 - 4.1. **Beneficiaries use WhatsApp to share information on agricultural practices**, weather updates, and market prices to help farmers make informed decisions.
 - 4.2. **WhatsApp groups bring together farmers**, agricultural extension officers, and other agricultural value-chain stakeholders to share experiences and ideas.
 - 4.3. **Farmers use WhatsApp groups to get information** on crop market prices, connect with potential buyers, and negotiate prices to help farmers get better crop prices and increase their profits.
 5. **Many interviewed beneficiaries highlighted the cost of devices and data makes it difficult to use digital solutions consistently**. According to GSMA, of the countries surveyed for the State of Mobile Connectivity Report 2022, Nigeria has the second highest percentage of mobile phone users stating device affordability as a barrier to internet use.⁵²
 6. **Many beneficiaries said they are rarely aware of or adopt solutions for digital agriculture outside of those introduced to them in IFAD programs**. This reflects the reality that most existing digital agriculture solutions **do not target smallholder farmers** and are not inclusive by design.
 7. The supply of digital agriculture solutions is constrained by the **absence of valuable datasets** that could drive innovation and change. Harnessing the power of data in agriculture requires a collaborative approach to increase the **availability, quality, and compatibility** of data.
 8. The Nigerian government has developed a National Digital Agriculture Strategy and a mobile digital agriculture solution, the National Adopted Village for Smart Agriculture. However, the government also needs help implementing policies and programs, as many digital agriculture-related initiatives have stalled due to **limited capacity to manage projects** and interface with other MDAs.

⁵² [GSMA State of Mobile Connectivity 2022](#)

RECOMMENDATIONS

1. Capacity Building and Digital Upskilling

Given the low digital literacy rate amongst smallholder farmers, addressing low digital literacy is critical to ensuring the increase in the uptake of digital agriculture solutions. Digital skills enable smallholder farmers to utilize digital tools and technologies effectively. These skills include using smartphones, accessing the internet, navigating agricultural apps, and interpreting data for informed decision-making.

The recommendation is for IFAD-funded projects to invest in the scale up of digital skills training and the sensitization of digital agriculture as a standalone initiative by contracting organizations to assist SHFs with digital training. Upskilling digital capabilities and the sensitization of digital agriculture to SHFs can be achieved through strategic partnerships that leverage existing initiatives with both public and private sector organizations.

Government organizations like the [National Information Technology Agency's Capacity Development Initiative](#), and the [Universal Service Provision Fund's Community Resource Centers Project](#) are already operating in the digital skills training space and already have the technical and financial resources to deploy, and so are non-profit digital skill empowerment organizations like [SiFi](#), [Tech4Dev](#), and [TechQuest](#). IFAD can help bring their attention to digital agriculture and the current SHF segment. IFAD can, through its involvement with SHFs, suggest the skills required by SHFs, provide introductions to SHF clusters, and suggest the locations in the country that would be best suited for this type of intervention.

When considering training interventions, the following are recommended:

- **Continuous training** and capacity-building initiatives to equip smallholder farmers with essential digital skills.
- **Basic training** on using mobile phones, accessing the internet, and navigating digital platforms.
- **Advanced training** in data management, online market access, and precision agriculture techniques.
- **Leveraging WhatsApp for real-time communication**, sharing multimedia content, and providing instructional videos and audio tutorials to train smallholder farmers in rural areas (targeted at extension workers and farmer organisations).

2. Implementation Support Centers

An IFAD-financed Implementation Support Center can provide assistance, guidance, and support to facilitate the implementation of the Digital Agriculture Strategy and Adopted Village for Smart Agriculture. The center can offer technical expertise and advisory services to individuals, communities, organizations, or governments involved in implementing a particular initiative.

The Implementation Support Center can enhance the effectiveness and efficiency of digital agriculture project implementation by providing targeted support tailored to government initiatives and policies' specific needs and requirements. The centers can play a crucial role in ensuring the successful execution of projects by providing specialized knowledge, skills, and resources to address

implementation challenges and promote effective project management. Given the number of institutions involved with implementing the digital agriculture strategy, the center can act as a central hub or focal point where stakeholders can access relevant expertise and receive practical support throughout the project lifecycle.

The government has already created the framework for increasing the uptake of digital agriculture in the country. With the strategy's incipiency, it is imperative to provide some technical support to ensure the process fully gets off the ground, as the policies impact the IFAD focus areas of productivity, climate resilience, market benefits, and financial inclusion.

Roles:

The Implementation Support Centers would be established with NITDA, FMARD, and the Federal Ministry of Communications and Digital Economy.

IFAD can provide training and technical assistance to NITDA and FMARD in delivering digital agriculture programs. It can do this in-house through its digital agriculture specialist or work with the private sector. A lot of IFAD's work will go beyond project management and involve acting as a convener, bringing together academic institutions, state agencies, and the private sector to bridge the policy-to-practice gap.

3. Low Tech Support

Many digital agriculture solutions in Nigeria are not inclusive by design. To ensure inclusivity and usability for underrepresented groups, IFAD can leverage its influence to encourage digital agriculture tool designers to consider the needs of less commercially attractive potential users or to provide financial support by subsidizing the adaptation of these tools. By doing so, these populations will find the tools more relevant and user-friendly. Additionally, involving groups with lower levels of education in the design process can guide designers towards simpler interfaces with less text and more audio, ultimately increasing these users' engagement with the final product.

This recommendation includes:

- **Ensure inclusivity** and usability of digital agriculture solutions for underrepresented groups by encouraging tool designers to consider the needs of less commercially attractive users.
- **Provide financial support** to subsidize the adaptation of digital tools to make them more relevant and user-friendly for these populations.
- **Identify digital agriculture platforms** traditionally accessed through apps or browsers and incorporate features for basic phones using SMS, Unstructured Supplementary Service Data (USSD) and Interactive Voice Response (IVR) technologies.
- **Involve groups with lower levels of education in the design process** to create simpler interfaces with less text and more audio, increasing user engagement
- **Ensure digital agriculture solutions are available in local languages** and use pictorial or graphical interfaces to increase accessibility for farmers with limited language literacy.

4. Telecommunications Infrastructure

Rural areas' lack of telecommunications infrastructure poses a significant barrier to using digital agriculture technologies. In this intervention, IFAD-funded projects would collaborate closely with mobile network operators and the Universal Service Provision Fund to identify potential rural areas lacking connectivity.

Through this collaboration, IFAD-funded projects could leverage data on the digital presence of their beneficiaries to provide valuable insights and information to mobile network operators, helping them make informed decisions regarding the deployment of base stations in rural areas.

By working together, IFAD, the government, and mobile network operators can prioritize and implement the deployment of base stations in the suggested rural areas, ultimately increasing connectivity and bridging the digital divide.

IFAD would gather data and conduct assessments to determine the areas needing improved connectivity and the potential ROI for the MNO (financially and socially). IFAD would then engage in dialogue and negotiation with the mobile network operators, presenting the identified areas and highlighting the potential benefits of deploying base stations in those locations. The focus would be on underserved rural areas where large clusters of SHFs operate, and connectivity gaps exist.

Nigeria's Universal Service Provision Fund (USPF) is a government initiative established to bridge the digital divide and provide access to telecommunications services in underserved and unserved areas of the country. USPF has an [Accelerated Mobile Phone Expansion Program](#) that subsidizes the deployment of Base Transceiver Stations (BTS) and other passive infrastructure in underserved and unserved communities in Nigeria to achieve 100% coverage of Local Government areas.

IFAD's role would involve advocating for the importance of connectivity in specific rural areas and highlighting the potential positive impacts on agriculture, economic opportunities, and overall community development. IFAD would also help MNOs with their challenges in making informed decisions about infrastructure deployment in rural Nigeria due to a lack of demographic data. This lack of data hinders their ability to assess the potential demand for services, understand the specific needs of the rural population, and prioritize areas for network expansion.

5. Data Infrastructure

To address the challenges around the uptake of digital agriculture and the supply of solutions, it is important to effectively utilize the growing amount of data generated by IFAD-funded projects, governments, organizations, and individuals. Access to and utilization of data at various levels can bring about transformative solutions for longstanding and emerging issues, benefiting farmers and developers of digital agriculture solutions.

Many Digital Agriculture Solution providers invest significant time and resources in gathering and generating data for developing and refining their technical and business models. This includes administration and legislation, socio-economic, agronomic, natural resources, and earth and environment data. However, valuable datasets that could drive innovation and change aren't often

readily available. Current efforts to share and publish data aren't coordinated enough to maximize impact, even between IFAD-financed programs. To harness the power of data in agriculture, there is a need for IFAD to help lead a collaborative approach to increase the availability, quality, and compatibility of data.

One model can involve IFAD spearheading the development of an agricultural data platform/infrastructure and providing its internally generated data set for free to solution providers and potential developers. The process could begin with assessing agriculture data infrastructure covering data protection, interoperability, APIs, storage, and data gaps. It could also assess the quality of current agriculture data, its usefulness, and its limitations. A policy and regulation assessment would also be carried out to identify any gaps that could hinder the development and utility of the platform/infrastructure.

IFAD would need to work with the FMARD, NiMET, Central Bank of Nigeria, National Bureau of Statistics, State Governments, and other development agencies (like GIZ, USAID, and FCDO) that are collecting agricultural data in Nigeria, and the private sector and non-profit digital agriculture solution providers to contribute to data collection by continually sharing relevant data.

Aggregating and merging agricultural datasets can be challenging due to various factors, such as:

- Agricultural data may be scattered across different sources and formats, making it difficult to collect and integrate into a cohesive dataset. Data may come from government agencies, research institutions, private companies, and individual farmers, each with data management systems and protocols.
- There may be inconsistencies in data formats, variables, and quality, requiring careful data cleaning, standardization, and validation processes. Datasets may use different units of measurement, naming conventions, or data collection methodologies, making it challenging to merge them seamlessly.
- Ensuring data privacy and security can be a concern when merging datasets. Agricultural data often contains sensitive information about farmers, their land, and their practices. Respecting data privacy regulations and maintaining data confidentiality while merging and aggregating datasets is crucial.
- Coordinating and collaborating with different data stakeholders can be complex. Each organization or entity may have policies, interests, and priorities requiring negotiation and agreement on data sharing, ownership, and usage rights.

While aggregating and merging agricultural datasets can present challenges, they are manageable. Proper planning, coordination, data governance frameworks, and technological tools can overcome these challenges and create comprehensive and reliable agricultural datasets.

ANNEX 1: DIGITAL AGRICULTURE SOLUTIONS

Product Name	Location	Focus
ThriveAgric	Abuja, Federal Capital Territory, Nigeria	Building the largest network of profitable farmers across Africa.
Hello Tractor	Abuja, Federal Capital Territory, Nigeria	Hello Tractor is an AgTech company that connects tractor owners to smallholder farmers needing tractor services.
Releaf	Lagos, Lagos, Nigeria	Releaf uses supply chain technology to get African FMCGs and their ingredients cheaper. Backed by Y Combinator, Samurai Incubate, Future Africa
Farmcrowdy	Lagos, Lagos, Nigeria	Farmcrowdy is a digital agriculture platform focused on connecting farm sponsors with real farmers.
Crop2Cash	Ibadan, Oyo, Nigeria	Making formal financing accessible to smallholder farmers.
Afrimash	Ibadan, Oyo, Nigeria	Afrimash is an e-commerce company that offers and supplies agricultural items across all brands.
Vetsark	Lagos, Lagos, Nigeria	Vetsark helps farms and agribusinesses digitalize and gain access to credit.

Isidore	Lagos, Lagos, Nigeria	Isidore is an agricultural marketplace.
AirSmat Inc	Lagos, Lagos, Nigeria	AI-Powered Platform - Helping farmers achieve bountiful yield.
Rice Afrika	Ikeja, Lagos, Nigeria	Rice Afrika is the rice-ONLY platform connecting all stakeholders in the value chain towards creating valuable interactions.
TradeBuza	Nguru, Lagos, Nigeria	TradeBuza is a tech-enabled commodities sourcing platform for commodities aggregators and outgrower schemes.
Rural Farmers Hub	Abuja, Federal Capital Territory, Nigeria	Precision advisory services guided for farmers, corporates, and the ag desk of financial institutions
Kitovu Technology Company	Iseyin, Oyo, Nigeria	Kitovu is a web/mobile-based decentralized fertilizer/seedling warehousing system that matches the right inputs to the right inputs
Kitovu Technology Company	Iseyin, Oyo, Nigeria	Kitovu is a web/mobile-based decentralized fertilizer/seedling warehousing system that matches the right inputs to the right inputs
Kitovu Technology Company	Iseyin, Oyo, Nigeria	Kitovu is a web/mobile-based decentralized fertilizer/seedling warehousing system that matches the right inputs to the right inputs

Ecotutu	Lagos, Lagos, Nigeria	Ecotutu offers cold storage and specializes in the fields of logistics, freight service, and delivery.
FarmSpeak Technology	Lagos, Lagos, Nigeria	We are innovators modernizing sub-Saharan agriculture through the use of IoT technology.
EZFarming	Lagos, Lagos, Nigeria	EZFarming is a marketplace that helps farmers finance their businesses and sell their products.
Awesome Fresh	Jos, Plateau, Nigeria	Agtech, Digital Agriculture, Innovative Supply Chain, Cold Chain Company
FarmCorps	Ikeja, Lagos, Nigeria	FarmCorps connects smallholder farmers with lenders and buyers with the help of data-driven advisory for sustainable food production.
Energy Assured Nigeria	Azare, Lagos, Nigeria	Energy Assured is a social enterprise company helping low-income farmers with a subscription-based, comprehensive, and mobile solar pump.
Beat Drone	Lagos, Lagos, Nigeria	Beat Drone is a company that helps the oil and gas, agriculture, and infrastructure industries reduce costs and increase efficiency.
Uzoebo Nigeria	Enugu, Enugu, Nigeria	Uzoebo is a hub for raw and processed agricultural products that aims to increase food availability, promote local food, and reduce wastage.

BirdPreneur	Abeokuta, Ogun, Nigeria	BirdPreneur is a shop platform that focuses on helping individuals and corporate organizations raise birds.
Tractor On The Go	Lagos, Lagos, Nigeria	Tractor On The Go is an agricultural value-chain conglomerate company.
Produce Africa	Abuja, Federal Capital Territory, Nigeria	Agriculture technology platform bringing end-to-end capabilities
Rucove	Abia, Abia, Nigeria	Rucove put together people, data, and a network to make agro-cross-border trades happen
Farmplify	Lagos, Lagos, Nigeria	Farmplify is an agricultural consulting company that supplies food crops, exporting crops, and processing crops in bulk.
AyosifamHub	Ilorin, Kwara, Nigeria	AyosifamHub is an agricultural marketplace that connects small-scale cassava farmers to cassava processors and investors.
Trackball Global Technologies	Abuja, Federal Capital Territory, Nigeria	Trackball Global Technologies is an e-learning platform that provides farmers with production practices.
Verdant Agri-Tech	Abuja, Federal Capital Territory, Nigeria	Verdant Agri-Tech offers solutions to support farmers and other stakeholders in the agricultural value chain.

Zenvus	Owerri, Imo, Nigeria	AgTech companies using soil sensors and cameras to build an interface between farm data and financial institutions like banks and insurers
Voriancorelli	Abuja, Federal Capital Territory, Nigeria	Voriancorelli is a marketplace that matches buyers, sellers, commodity aggregators, logistics partners, financiers, and food processors.
DayDone	Ibadan, Oyo, Nigeria	Online Platform for Farm Produce; quality agricultural produce and experience at your doorstep and fingertips
EveryFarmer	Abuja, Federal Capital Territory, Nigeria	EveryFarmer is an Integrated Farming Service Platform
Agropartnerships	Lekki, Lagos, Nigeria	Agropartnerships is a global digital platform for investing in farms and trading agricultural commodities.
Agrorite	Lekki, Lagos, Nigeria	Agrorite is a technology-driven company that helps farmers with high-impact social investment and profitable markets.
Anitrack	Ebonyi, Nigeria	Anitrack delivers management tools to monitor livestock health and movement that notify farmers immediately and link them with animals.
E Farms	Iseyin, Oyo, Nigeria	E-Farms is an agricultural fintech company that specializes in building sustainable agribusinesses and market access for traceable produce.

AgroMall	Lekki, Lagos, Nigeria	AgroMall is a digital agricultural firm that offers primary production, education, dairy development, agri-business, and financial services.
Virtual farm and foods	Calabar, Cross River, Nigeria	Virtual Farm and Foods is a digital farm in Africa, where users can buy seeds online, sow, nurture, and harvest online.
Farm4Me	Abuja, Federal Capital Territory, Nigeria	No.1 Agritech Company in Nigeria. We help you profit greatly from agriculture in Nigeria.
AGROVAT NIGERIA	Abuja, Federal Capital Territory, Nigeria	Agriculture Education
Farm Innovation	Abuja, Federal Capital Territory, Nigeria	Farm Innovation is to develop innovative solutions that see farmers improve their processes, increase their yield, and increase their income.
Novus Agro	Lagos, Lagos, Nigeria	Novus Agro is an agricultural market and professional services firm.
ReQuid	Lagos, Lagos, Nigeria	ReQuid helps to invest in agrotech companies and manage portfolios on a single platform with the option of liquidating at any time.
Trado Global Limited	Osogbo, Osun, Nigeria	Trado Global is a digital agriculture platform focused on offering profitable investment and connecting farmers with real farm sponsors.

JMeggro LLC	Owerri, Imo, Nigeria	"JMeggro LLC runs the biggest e-commerce platform in Nigeria, focused on agricultural products.
Zido Global	Lekki, Lagos, Nigeria	Zido Global is a digital freight and distribution platform.
Ajeoba Agro Exchange	Ikoyi, Lagos, Nigeria	Ajeoba is a digital infrastructure provider that focuses on closing gaps in the agricultural value chain.
Foodstock Farmers Market	Lagos, Lagos, Nigeria	Nigeria's No 1 Online Farmers Market. We deliver fresh farm produce straight from the farm to our customer's doorstep.
AgroInfoTech	Ibadan, Oyo, Nigeria	AgroInfoTech provides services to change in agricultural stakeholders.
KODGAV NG	Abuja, Federal Capital Territory, Nigeria	Agtech platform creating new data-driven food systems by integrating African smallholder farmers into a global supply chain.
Honey Flow Africa	Port Harcourt, Rivers, Nigeria	Honey Flow Africa optimizes beekeeping operations by digitizing and bringing the power of IoT and AI
AgroNigeria	Ikeja, Lagos, Nigeria	AgroNigeria is an online news portal that reports agricultural activities.

Agriple	Abuja, Federal Capital Territory, Nigeria	Agriple is an online platform that provides analytics that helps farmers determine the best crops to plant.
Nourishing Africa	Lagos, Lagos, Nigeria	Nourishing Africa is a platform for agri-food entrepreneurs enabling them to accelerate the progress of their work.
African Village Market (AVM)	Lekki, Lagos, Nigeria	An online farmers market and delivery service that allows customers to shop directly from local farmers and food businesses in their region.
Farmcenta	Ikeja, Lagos, Nigeria	Farmcenta is an agri-tech firm that provides agricultural consulting, financing, and commodity aggregation services.
AGROBINT	Lagos, Lagos, Nigeria	Agrobrint is an AgriTech company that provides smallholder farmers with funding, training, and access to the market.
Pullus Africa	Kaduna, Kaduna, Nigeria	AgTech solving supply chain challenges of African poultry farmers
Agroexchange Technology Services	Akure, Ondo, Nigeria	Agroexchange Technology Services is a digital technology firm that uses satellite data to give farmers early warning of crop health issues.
Alosfarm	Lagos, Lagos, Nigeria	Web platform helping small-scale farmers to be sustainable and profitable

Ndidiaa	Uyo, Akwa Ibom, Nigeria	Online Food Store
AgroMarket	Lagos, Lagos, Nigeria	AgroMarket is an Agri products advertising platform that focuses on bringing farmers and sellers on one platform for hassle-free shopping.
Africa Wealth Initiative	Oyo, Oyo, Nigeria	Africa Wealth Initiative is delivering food value, building farmers, and economic improvements through Agricultural Investments.
Supremarts Limited	Ogun, Oyo, Nigeria	AgricTech Embedded System & SaaS Solutions converting regenerative farmers to close organic using technology.
Farmers.NG	Ondo, Oyo, Nigeria	Farmers.NG is the 'within-reach solution' for farmers located in rural areas of Nigeria.
Farmsby	Port Harcourt, Rivers, Nigeria	Farmsby is an IT company that provides decentralized farm management software for farmers to sell, purchase, and trade products.
CropHQ	Lagos, Lagos, Nigeria	CropHQ is a revolutionary Agricultural Powerhouse providing agricultural support for African Farmers
ProbiySoftware	Lagos, Lagos, Nigeria	ProbiySoftware offers a suite of products for farms, cooperatives, hospitals, schools, and manufacturers.

<u>RUBILABS VETERINARY SERVICES (RVS)</u>	Abeokuta, Ogun, Nigeria	RVS is Africa's largest livestock marketplace. We provide everything a livestock farmer needs for poultry, ruminants & fish farming.
<u>Farmeble</u>	Lagos, Lagos, Nigeria	Agtech startup that helps farmers produce more and earn more.
<u>Clavis Express</u>	Ikoyi, Lagos, Nigeria	One-stop digital platform for wholesale premium frozen foods in Africa.
<u>Farmers' Corner</u>	Lagos, Lagos, Nigeria	We connect farm operators to communicate farm problems through extensionists, sell agricultural products, and share networks through events.
<u>Viable X</u>	Abuja, Federal Capital Territory, Nigeria	Viable X focuses on connecting commodity suppliers with commodity off-takers to carry out mutually profitable transactions.
<u>farmhub360</u>	Lagos, Lagos, Nigeria	Farmhub360 is a marketplace and E-commerce Platform.
<u>FarmSpark</u>	Lagos, Lagos, Nigeria	Farm Spark is a platform that connects smallholder farmers in Nigeria to certified, reliable, and affordable agro-service providers.
<u>SecureFarm</u>	Oyo, Oyo, Nigeria	We are a co-farming platform that aids farmers in Nigeria by offering access to land, mechanical & digital tech, credit, and knowledge.

<u>Bridge Merchant</u>	Ikorodu, Lagos, Nigeria	Bridge Merchant works with companies, farmers, and agents to improve the Agricultural supply chain, from sourcing through to delivery.
<u>Oga Farmer</u>	Ibadan, Oyo, Nigeria	Oga Farmer is an agritech company that empowers farmers to access funds to expand their farm projects to increase their profitability.
<u>OpenFarm Network</u>	Ikeja, Lagos, Nigeria	OpenFarm Network is a marketplace to provide emerging farmers with data and insights for making decisions on production needs.