

Innovations and policy design for development for cross-value chain services (logistics and financial services)

Country Scoping Report - Nigeria

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CONTENTS

- 1. INTRODUCTION 1**
 - 1.1 Background – WP3 1
 - 1.2 Methods and objectives..... 1
- 2. REVIEW OF AGRI-FOOD CROSS VALUE CHAIN SERVICES (CVCSS)..... 2**
 - 2.1 Situation analysis-logistics services..... 2
 - 2.1.1 General Background..... 2
 - 2.1.2 Types and sources of agri-food logistics services providers in Nigeria 4
 - 2.1.3 Government schemes/programs in the agri-food logistics sector 10
 - 2.2 Situation Analysis – Financial Services (Digital) 11
 - 2.2.1 General background 11
 - 2.2.2 Key features of agricultural financial services in Nigeria 12
 - 2.2.3 Government schemes/programs in the agri-food sector finance 16
 - 2.2.4 Smallholders and digital financial services (DFS) in Nigeria 16
- 3. EMERGING LOGISTICS AND DIGITAL FINANCE SERVICES (DFS)..... 18**
 - 3.1 Emerging logistics services 18
 - 3.2 Emerging digital financial services (DFS) 22
 - 3.2.1 Emerging private sector-led initiatives in DFS in the agricultural sector 23
 - 3.2.2 Government-led initiatives in DFS 25
- 4. CURRENT CHALLENGES AND OPPORTUNITIES – LOGISTICS AND FINANCIAL SERVICES. 26**
 - 4.1 Cross value chain logistic services 26
 - 4.2 Cross value chain digital financial services (DFS) 30
- 5. PROMISING LOGISTICS AND FINANCIAL INNOVATIONS FOR PILOTING 34**
 - 5.1 Innovative logistics services and potential partners 34
 - 5.2 Innovative DFS and potential partners 36
- 6. CONCLUSION..... 38**
- About the Authors 40**
- Acknowledgments 40**

References	41
Annexes.....	43

TABLES

Table 1. Credit and savings behavior of rural households	12
Table 2. Logistics services providers in agri-food sector in Nigeria	19
Table 3. Innovations and potential partners for agri-food logistics services	34
Table 4. Innovations and potential partners for DFS in agri-food cross value chains services...	37

FIGURES

Figure 1.Total demand for agricultural financing in Nigeria	13
Figure 2. Commercial bank credits to agricultural sector (2014-2020)	14
Figure 3. (a) Growth of informal financial services; (b) Informal financial service use by smallholder farmers.....	15
Figure 4. Key features agri-finance services among Smallholder farmers in Nigeria.....	17

1. INTRODUCTION

1.1 Background – WP3

WP3 intends to address the question: How can cross-food value chain and market services function better to increase employment and boost income of smallholders and SMEs? The WP focuses on two types of cross-value chain services, logistics and financial services.

- (1) *logistics services* – supply chain management, transportation, traceability, digital platforms for e-commerce, and (cold) storage.
- (2) *value-chain financial services* – mainly focusing on digital financial services (DFS) that facilitate transactions, savings, access to and use of credit, and insurance.

The logistics services in agri-food systems in low- and middle-income countries (LMICs) are often targeted at large-scale enterprises with greater market power and less accessible to smallholder farmers and small and micro enterprises (SMEs). WP3 aims to assess the ways in which these emerging logistics services (including digital platforms) can be cost-effectively targeted at smallholder farmers and agri-food SMEs. Regarding DFS, the WP will investigate cost-effective ways of improving access to and adoption of DFS among smallholders and agri-food SMEs, especially among women and youth. Though these emerging DFS appear to have a high potential to benefit smallholders and SMEs across the agri-food value chains in LMICs, they need a reliable internet connection, a suitable mobile phone network, and a broad network of mobile money agents to be effective. WP3 thus aims to identify innovations/emerging logistics and DFS and test their effectiveness to smallholders and SMEs using randomized control trials (RCTs) in pilots, with the goal of country-specific scalable designs.

1.2 Methods and objectives

This report is based on desk review, key informant interviews, field visits, and consultations of stakeholders including virtual meetings and phone calls. The scoping report documents summary findings from landscape analysis and stakeholders mapping of cross-value chain logistics and financial service providers operating within the agri-food sector in Nigeria. The logistics services component of the report provides a summary of activities geared to understand logistics services provision within the Nigerian agri-food system, including – mapping key logistics services providers, what value chains they cover, the nodes at which they operate (e.g., production, processing, storage, and distribution), what specific roles they play, their geographic coverage and the extent to which they use digital technologies. Similarly, the DFS component of the scoping report covers mapping of key financial services providers identified so far

along the agri-food value chain, the nature/types of emerging DFS innovations, scale of operations, geographical coverages within Nigeria, and the growing demand for the DFS among the beneficiaries.

The key objectives of the scoping report (on both logistics and financial services) are: (1) document the state-of-the-art in these services to better understand their current state and functionality; (2) identify gaps and challenges to help us design innovations or interventions for piloting; (3) identify the list of potential/feasible innovations to experiment or pilot; (4) identify demand partners and scaling partners for piloting the identified innovations; (5) ground truth the applicability and acceptability of proposed innovations and intervention modalities with local stakeholders and beneficiaries; and (6) lay a foundation for baseline survey and experimental design. In addition, the scoping report provides useful information on certain value chains which are already being served by cross-value chain services (logistics and finance) and the potential candidates for innovation (digital and finance services) and increasing inclusion among smallholders and SMEs.

2. REVIEW OF AGRI-FOOD CROSS VALUE CHAIN SERVICES (CVCSs)

This section presents a concise review of the situations of logistics services and financial services in the agri-food sector in Nigeria – first, a summary of logistics services (sub-section 2.1) followed by the key features of agricultural financial services (sub-section 2.2) in Nigeria.

2.1 Situation analysis-logistics services

2.1.1 General Background)

Logistics is part of the supply chain process that plans, implements, and controls the efficient, effective flow and storage of goods, services and related information from the point-of-origin to the point-of-consumption in order to meet customer requirements and satisfies the requirements imposed by other stakeholders such as the government and the retail community (Vorst van der and Snels, 2014).¹ Over the last few decades, there has been rapid growth in the number of logistics service providers in Nigeria and other developing regions. This expansion is transforming the industrial organization and operations of food supply chains in these countries. It is one of the fastest-growing industries in Nigeria, though still in its nascent stage. As of 2018, the value of Nigeria's logistics sector was estimated to be 250 billion naira

¹ According to Shufeng et al. (2010) modern agro-logistics should consist of 12 functional elements of procurement, supply, storage, transportation, loading and unloading, sorting, packaging, distribution, distribution processing, marketing, recycling, and information control.

(\$696 million), an increase of 50 billion naira (\$140 million) from 2017 statistics (International Trade Administration, 2021). Recently, the Nigeria freight and logistics market has been on a slow growth trend but is expected to grow by 4 percent per annum in the coming years (Modor Intelligence, 2021).

Logistics services (e.g., cold chain or other storage facilities and transportation services) are critical for the efficient function of food supply chains. They play an important role in determining the quantity, quality, and cost of (i) inputs available to farmers, (ii) agricultural and food products received by numerous food processors, and (iii) food available to food consumers in formal and informal markets. To this end, logistic services must be adapted to the type of agricultural products. For instance, storage and handling operations for grains (cereals and pulses), roots, and tubers are expected to substantially differ from those useful for high perishable products such as fresh fruits and vegetables, fish, meat, and dairy products. This product-specialization in logistics operations is important to ensure an effective delivery of the service in the agri-food value chain.

The rapid growth in the number of logistics service providers in Nigeria is transforming the organization and operations of food supply chains. On one hand, logistics service provision is a source of income for the owners and employees of the numerous small and medium scale enterprises (SMEs) engaged in logistics service provision. On the other hand, it is also transforming the market channels farmers, processors and traders can sell their products to or use to secure quality inputs. For example, there has been an expansion of private companies (including several start-ups) addressing the logistics challenges that farmers face in input and output markets in rural areas. These SMEs finance and deliver inputs through risk sharing agreements and provide a suite of services that help smallholder farmers overcome production challenges through an integrated service provision sector often referred as Farm Aggregation Services (FAS). Many of these FAS serve as a one-stop-shop that provide multiple services that bridge the gap between farmers, input providers, and agro-processors who require significant quantities of the farmers output but often experience inadequate supplies both in terms of quantity and quality (Liverpool-Tasie et al., 2019). Some FAS provide a range of supply chain support to farmers (e.g., land mapping, input delivery, mechanization, training on good agronomic practices, harvesting, aggregation and sales) allowing them to focus on crop production. This arrangement reduces the risk of finance provision to the farmers by financial institutions and supports the farmers to better manage the credit provided. FAS are therefore a holistic approach to improve the logistics services in the agri-food value chains, especially in the rural areas.

An effective agricultural supply chain must reduce the logistic costs, limit food loss along the chain, and ensure faster delivery of products. In Nigeria, as much as between 20 and 30 percent of total grain production, between 30 and 50 percent of root and tuber, and around 30 and 50 percent of

FFVs (Fresh Fruits and Vegetables) are lost during the post-harvest stage due to poor processing, marketing, distribution, and storage facilities (Yahaya, 2002). A reduction in losses and waste, which stands at around 40 percent of all food produced, increases food availability in regions where it's grown and most needed and can enable the ability to diversify diets to a more nutritious one (Adekoya, 2020). Therefore, improved logistics, that could reduce food loss and waste provides immediate impact for the poorest and most vulnerable, maximizing output from land and natural resources already under production (World Bank, 2020).

2.1.2 Types and sources of agri-food logistics services providers in Nigeria

A) Road transport services

Road transport services are the most used mode of transportation in agricultural logistics in Nigeria and elsewhere in SSA. It is estimated that 70 percent of agricultural produce is transported through the road system that represents 195,000 km in 2019, of which 31 percent is paved (Nation 2020, LCA, 2019). The typical in-country rural-urban food distribution system in Nigeria for crops consists of three stages, (i) farmers sell small surpluses of their produce to traders (middlemen) in their village markets or at assembly points, (ii) once small quantities from scattered farm holdings are collected, the traders move the produce to secondary collection centers, (iii) the produce is then moved to central wholesale markets in urban centers or to processing units (Marras et al., 2017).² Though the road transport system is one of the biggest industries in Nigeria and holds huge potential for agricultural and rural transformation, it is one of the most poorly coordinated.

The motorized transport fleets in rural areas are dominated by small and old vehicles. Road transportation in the agri-food value chain is associated with crop cultivation, movement of farm inputs, crop harvesting and crop marketing. The produce is transported from farms to collection centers primarily by carts, bicycles, motorbikes, rural taxis, or motor vehicles. These transportation means, while providing vital rural transport, can be invisible to policymakers and thus may be poorly managed and relatively unregulated (Starkey and Njenga, 2010). From collection centers to urban central wholesale markets, transportation is mainly done in open, non-refrigerated trucks with capacities ranging from less than 10 tons to up to 30 tons (Aworh, 2005; Busari et al., 2015). This delivery takes a significant amount of time and money to reach urban centers from rural, often because of truck shortages, especially refrigerated transport suitable for perishable crops and bad roads.

Where road transport services exist, they are often expensive and overcrowded because the transport system is inefficient. The cost of moving produce to market is often prohibitive in terms of the transport service fare, time, and physical losses, which are exacerbated by the poor road conditions

² There are also transport services of finished manufactured goods from the processing units to distribution markets (wholesale and retailers). This report does not discuss the logistics of these goods.

and sometimes frequent road checkpoints. Delay in transportation services often limits the financial capability of producers to hire vehicles when needed and increases reliance on inappropriate means of transportation. This delay in moving produce from the point of production to either market or processing centers could result in both physical and financial losses. For this reason, many farmers often trade at the farm-gate to avoid the need to transfer harvests to market, which can be risky, particularly with perishable goods. Indeed, up to 70 percent of the fresh agricultural produce could be spoiled during road transportation. It was also estimated that in 2014, 50 percent of losses of plantains and bananas in Nigeria occur during transportation from the farm to marketplaces, and account for 2.5 percent to 6.6 percent of wholesalers' potential total revenue (Marras et al., 2017).

The supply of road transport logistics is highly fragmented in nature with the presence of heteroclite market players. The transport system is characterized by large numbers of small-scale operators with limited professional and business capacity, uncoordinated activities and services leading to inefficiency and non-compliance with traffic regulations (PUB and IIT, 2014). They provide within state and interstate transport services. There are also large and formal logistics players offering agro-logistic services, including TAK logistics, Red Star Logistics, MDS logistics, among others. These companies provide specialized services for agro-industrial and agribusiness companies. They usually operate on several logistics segments transporting products from farmer aggregation centers to warehouse and processing units (TAK, 2022). They also offer cold chain solutions to keep products fresh along the chain. Another category of service provider has emerged because of the growth of e-commerce and ICT platforms. They own trucks or rely on third-party logistics to deliver agricultural products to their customers. Others, like Kobo360, operate online platforms to improve the coordination of supply and demand for truck services. But these startups' services are still very limited in the agri-food value chain and are not accessible to smallholder farmers.

B) Rail transportation services

There has been a gradual return of rail transport services that could contribute to boost the agriculture value chain in Nigeria. Three decades ago, the movement of cattle and farm produce from the North was undertaken by rail. But this transport service has recorded an unstable performance trajectory, with a definite downward spiral between 1985 and 2009 (Abioye, 2016). During this period, rail freight volumes (in tons) declined by as much as 95 percent (Aebukola, 2022). From 2010 onwards, the performance of the rail freight has gradually increased, though there is still significant room for growth.

The rail transportation services need to be improved to reduce the enormous burden on the congested roads and to become a reliable alternative. The rail network is strategically positioned through the heart of major farming regions across the country. In addition, transport costs incurred in the use of rail transport is cheaper at every distance range (Abioye, 2016). The unit cost of freight transport with rail

freight costs ranges from 11 to 44 percent of road haulage charges. Per capita energy use is also lower for rail relative to road, making the former more environmentally friendly (Adebukola, 2022). A major disincentive for freight owners and users, however, is the slow speed offered on rail compared to road transport, due to low frequencies of service and the elongated transport time. The trains also lack facilities for ferrying livestock in a healthy and efficient way. The Nigerian Agribusiness Group reports that farmers lost 31 cows out of a batch of 1820 during rail transportation and offloading (Nation, 2020). Losses were also observed during tomato transportation because of lack of appropriate air-conditioning. If the current challenges are solved, the rail services could provide substantial opportunities to develop the logistics for agricultural and livestock products.

The service providers in the rail transport are more regulated and less fragmented compared to the road transport industry. The Nigerian Railway Corporation (NRC) manages the 4,332 km rail network that runs diagonally from the southwest (Lagos) to northeast (Nguru) and from the south-east (Port Harcourt) through Kafanchan to the north-east (Maiduguri). The Nigerian railways charges N7.10 per ton per km of dry goods rail freight while haulage rates range from N59.4 per km at 101 km to N15.6 per km at 1149 km distance (Adebukola, 2022). Private companies provide rail haulage services. For example, Connect Rail Services are tapping the growing opportunities in the railway services to farm organizations. They have developed refrigerated coaches meant for transporting perishables and dairy products from farm to market, and to the seaports in the case of agriculture produce that are meant for export (Nation, 2020). Traxport Rail Services is a special purpose vehicle established to obtain and operate a freight service between the southern port city of Lagos and the northern industrial city of Kano. They usually serve large agro-industrial players such as OLAM transporting grains, sesame, cocoa, and cashew (Traxport, 2022). TAK Logistics is also another large player operating on this logistics segment.

C) Storage services and handling practices

Storage is the activity of keeping products at warehouses, logistics centers or on farm. It provides a steady supply of goods to the market to fill the gap between producers and consumers. The assumption behind all commercial storage is that the price will rise sufficiently while the product is in storage to cover the costs of storage.

Some medium and large market players use modern silos and warehouses in metropolitan areas to engage in commodity trading. But there are a limited number of formal warehouse service providers. These SMEs store cashew nut, wheat sorghum and maize at different moisture content over medium to long periods (over two months). The Federal Government of Nigeria (FGN) has also constructed technologically improved grain storage silos to store the excess production in states. Nigeria invested NGN 66 billion (USD 171 million) to establish 33 silo complexes, 25 grain aggregation centers, and 9 units of Blumberg warehouses, which have later been privatized. The silos have a storage capacity

between 25,000 and 100,000 tonnes. A leading market player in the warehousing space is AFEX Commodities Exchange Limited (AFEX), which operates 60 warehouses in Nigeria, where affiliated farmers can deposit commodities such as maize, cocoa and soybeans (Food Business Africa, 2021). AFEX implements also the first Warehouse Receipt Backed Commercial Paper in Africa, with tech-enabled operations and a 24-hour fast cash turnaround for borrowers (Thompson, 2020). The warehouse receipt system can be used as collateral to unlock loans from financial institutions. Other private storage providers exist, but they either are small informal actors or large players serving large customers.

Most farmers in rural areas only have access to traditional and improvised structures for storage. Few of them resort to external storage services. They use storage technologies such as baskets, sacks, platforms, cribs, sheds with bam-boo-laid ceilings, and unoccupied rooms. Traditional storage facilities are implemented in rural areas to store grains for a few months or root and tubers for few weeks (Bankole et al. ,2013; Somorin and Bankole, 2010).

Challenges associated with various storage structures include quantity and quality losses, especially for traditional storage and handling practices. Losses are usually caused by pest damage (insect and rodent attacks), moisture penetration, rusting, molding, rodent infestation, and roof leaks, etc. Cowpea farmers lose 10 percent to as high as 100 percent after only a few months because of insect damage (Moussa et al., 2014). Maize can record up to 30 percent dry-weight-losses (DWL) in six months of storage (Boxall, 2002). Aflatoxin contamination has also been observed along the maize value chain in Nigeria, including in farm storage, in containers used for transportation, and in processed maize products (Paymal, 2018).

Research institutions have developed storage several technologies on small and large scales to address storage losses. The Federal Institute of Industrial Research Oshodi (FIIRO) designed and manufactured a prototype silo that can contain five tons of grains like maize and pulses like beans and soybeans. This silo could be smaller, depending on the user's production capacity. The Nigerian Stored Products Research Institute (NSPRI) has also developed several storage technologies ranging from 100 kg to thousands of tones. For example, an atmosphere silo for storage of grains had successfully stored wheat, among other grains, for four years without quality deterioration. But the post-harvest value chains had not been able to adopt the technology despite the high financial profitability; return per naira from wheat grains storage using the silo is 0.44 (Irogbba and Nnanna, 2019). Among hermetic technologies, hermetic bags are the most widely disseminated among smallholder farmers in sub-Saharan Africa (SSA). The use of hermetic bags to store grain has significantly increased in the past 10 years, spear-headed by the development of the Purdue Improved Crop Storage (PICS) bag (Baristuta and Cristine, 2020). The adoption of hermetic bags is driven by several factors, including: (i) the severity of storage losses at the farm level; (ii) the efficacy of the technologies, and (iii) benefits such as being chemical-

free, cost effective, easy to use. Other benefits of using PICS and other hermetic bags include the reduction in deaths and illness due to the misuse of insecticides and the mitigation of mold growth (leading to aflatoxin accumulation) that causes stunted growth in children and liver cancer (Barisbuta and Cristine, 2020). PICS bags come in three different sizes – 25 kg, 50 kg, and 100 kg bags. Improving the supply chain to deliver technology to farmers over the last mile will certainly increase the adoption of PICS bags. More generally, the low adoption of improved storage technologies by smallholder farmers is also often due to liquidity constraint that prevents them from forgoing spot sales to engage in speculative behavior (Rick-Gilbert et al., 2022).

D) Cold chain services and handling operations for highly perishable products

Cold storage logistics is another important logistics area that addresses the perishability of fresh fruits and vegetables, fish, meat, and dairy products. Chilling temperatures in cold chains vary between 0°C to 8°C whereas freezing temperatures are below -18°C.

A challenge with using cold chain is that the temperature must be maintained throughout the subsequent chain when applied to one node of the supply chain. That means cold chain at the procurement stage must be maintained downstream to the delivery stage. For instance, cooled transport can be problematic due to inspections along the hauling route, when container units are opened, and the cold chain is interrupted. This feature limits cold storage practices in open markets that lack appropriate storage technologies. Demand from supermarkets and other organized market outlets is therefore the main driver behind the cold chains as they have the capacity to maintain the cold chain (Sibomana *et al.*, 2018). But food sales through supermarkets only account for around 1 percent of total sales, and 80 percent of their food stocking is purchased from importers and wholesalers located in traditional open markets (Marras et al., 2017). More specifically, the supermarket supply chains, although growing, represent a small proportion of the fresh fruits and vegetables markets such as tomatoes (Sibomana et al., 2018).

Cold storage systems used in Nigeria include cold rooms, industrial blast freezers, solar refrigerators, mobile refrigerated trailers. Deloitte (2022) provides a detailed analysis of the cold storage sector in Nigeria. (i) An example of a cold room provider is ColdHubs, which provides plug-and-play modular, solar-powered walk-in cold rooms for 24/7 off-grid storage and preservation of perishable foods that can extend the shelf life of fresh fruits and vegetables from 2 days to 21 days (ColdHub, 2022). ColdHubs operates cold rooms with a maintained temperature of 5°C and a capacity of 2-3 metric tons of perishable food arranged in at least 150 units of 30kg (0.03 metric tons) plastic crates. (ii) The industrial blast freezer is a specialized stationary freezer used to preserve food at sub-zero degrees Celsius temperatures to prevent the growth of harmful bacteria that spoils food (ADK Kooling, 2016). An example of a blast chiller supplier is De Koolar Nigeria Limited. Their units are powered by grid connection or diesel generators or

solar energy systems. Another example is Eja-Ice Nigeria Limited, which offers solar powered freezers with natural refrigerants to fish retailers through affordable lease-to-own schemes. (iii) Solar refrigerators are ordinary refrigerators that are powered by the energy directly provided by sunlight. They are small with the holding capacity like ordinary refrigerators. (iv) Refrigerated trailer also known as “reefer” is a refrigerated container attached to a semi-truck and used to transport perishables and other temperature sensitive goods. Alyx Limited provides solar refrigerated trailers to help farmers transport produce from their farms to the markets. KCLL and Awesome Fresh are growing startups operating refrigerated transport through diesel powered generators.

Cold systems are available and operational across Nigeria. However, when compared to the number of farmers and agribusinesses who need this technology, there is a significant gap between the demand and supply of cold storage in Nigeria. There are several providers of cold chain equipment and facilities currently in operation in Nigeria. But most of the cold storage services that are available are primarily for the preservation of meat and fish, with comparatively few options suitable for the storage of fresh fruits and vegetables, and milk (Deloitte, 2022). This gap is pronounced in rural communities where most smallholder farmers lack access to cold storage solutions (Kibiti, and Strubenhoff, 2019).

The problem of loss due to the absence of cold chain extends beyond fresh agricultural produce to include dairy, sea food, and poultry with significant nutritional and economic consequences. It is estimated that 37 percent of Nigerian agricultural production requiring refrigeration is lost due to inefficient or non-existent cold chains (SeAll, 2018). Food spoiled from lack of cold storage causes 93 million small farmers in Nigeria to lose 25 percent of their annual income (Ikegwuonu, 2018). In Nigeria, 32 percent of Nigeria’s children are classified as stunted, and 2 million children suffer from severe acute malnutrition (Global Nutrition report 2018, 2020). Fresh vegetables like tomatoes are a rich potential source of several micro-nutrients essential for a healthy diet, but only if they are readily available and affordable for local populations, especially those on low incomes. Fish is integral to diets in Nigeria with the average Nigerian consuming 13.3kg of fish per year (Adeye, 2016). Yet between 40 and 50 percent of fresh fruits and vegetables are lost during crating, transportation, storage, and processing (Ikegwuonu, 2018). It is estimated that more than 40 percent of tomato production does not reach consumers (GAIN, 2020). Likewise, 50 percent of harvested fish is lost due to inadequate cold storage (FAO, 2017). The potential annual savings on post-harvest loss (PHL) for fish, milk, and some fresh fruits and vegetables is approximately NGN 110 trillion (US\$268 billion), which emphasizes the need for accessible and effective cold storage facilities and underlines the market potential for new or existing entrants into the cold storage market (Deloitte, 2022).

2.1.3 Government schemes/programs in the agri-food logistics sector

The FGN released new guidelines of courier and logistics services in July 2022 to enhance the logistics services to account for the introduction of e-commerce, and online vendors in the industry. Logistics is defined as delivery services which include haulage, conveyance, and dispatch/delivery of items or goods weighing not less than 50 kg. The delivery of merchandise and/or cargo with a weight of not less than 0.5 kg and not more than 50 kg is considered as courier services.

Sectorial policies or agencies also support the development of the logistics sector in Nigeria. Formal national transport policy is lacking, although several draft national transport policies have been produced historically. The 2010 draft transport policy represent the latest in a series (Oroleye, 2019). The FGN is now developing a new policy to unlock the country's economic potential in the context of the African Continental Free Trade Area (AfCFTA). The Securities and Exchange Commission (SEC) is the regulatory agency with licensing powers, oversight, and other supervisory rulemaking of the implementation activities of the warehouse receipts transactions on the commodities market ecosystem.

The FGN has been implementing several initiatives under the Agricultural Promotion Policy (APP) to revamp the logistics sector to make agriculture a key anchor of the economic diversification.

Building on success and lessons from the Agricultural Transformation Agenda (ATA), APP (2016-2020) aimed at improving agricultural infrastructure, resolving food shortages, and improving agricultural output. One of the main tenets of the APP is the provision of agricultural infrastructure such as small medium and large storage units and technologies, agro-distribution and processing facilities. The rural infrastructures were seen as an enabler of logistics services that deserved sustained investments. For example, through its [Credit Risk Guarantee and Loan Facilitation](#) services, the Nigeria incentive-based risk sharing system for Agricultural Lending (NISRAL) enables smallholders to benefit a low-cost and efficient transport link between producers and consumers. The scheme was projected to reduce the cost of transporting agricultural produce by over 20 percent, and minimize wastage and spoilage of goods in transit by over 40 percent (Nwannekanma, 2016). The initiative has already supported North-to-South movement of cattle by rail. The same initiative led to transport soybeans from Kaduna to Lagos. NIRSAL is also making progress on operationalizing other elements of the Farm to Market scheme such as the movement of perishable agricultural produce like tomatoes, dairy products, and vegetables in refrigerated containers. The [Anchor Borrowers Program \(ABP\)](#) of the Central bank of Nigeria (CBN) supported aggregation points and storage infrastructure in designated Local Government Areas (LGA) of each state. The ABP, launched in 2015, has been suspended since 2021 because of loan defaults (Punch, 2022).

The agricultural sector is identified in the Nigeria Development Plan (NDP 2021-2025) as a key driver of economic growth and diversification. As part of measures to reduce post-harvest losses, the FGN prioritizes developing critical rural infrastructure such as roads, reactivation of grain aggregation

centers. This strategy is taking shape in the Nigeria Special Agro-Industrial Processing Zones (SAPZ) initiatives launched in October 2022. The first phase of the Nigeria SAPZ program is co-financed by FGN and key development partners (AfDB, IDB and IFAD) to the tune of \$538.05 million. The Program will support the setup of SAPZ in seven states (Kano, Kaduna, Oyo, Kwara, Ogun, Imo, and Cross River) and the Federal Capital Territory (FCT). The first component of this program will address Infrastructure Development and Management for Agro-Industrial Hubs (AIH) with agricultural transformation centers strategically located within the production area to aggregate products from the community, transfer them to the AIHs for value addition and supply centers of demand for distribution and retail to consumers (IFAD, 2021).

2.2 Situation Analysis – Financial Services (Digital)

2.2.1 General background

Agriculture is a major source of employment and economic development in Nigeria, contributing about 23 percent to GDP (Statista, 2021) and a 70 percent share of the labor force (PwC, 2020). However, the sector suffers from two major challenges: (i) the sector's inability to meet domestic food requirements, and (ii) the inability of the sector to export at quality levels required by international markets (FMARD, 2016). The two recent agricultural policy documents for Nigeria – the Agricultural Transformation Agenda (ATA) (2010/11–2016) and the agricultural promotion policy (APP) (2016–2020) highlighted that low agricultural productivity driven by low use of modern agricultural inputs or technologies is the major constraint hindering the performance of the agriculture sector in the country. Poor access to financial services to smallholder farmers was identified as one of the key constraints limiting adoption of these agricultural technologies (FMARD, 2016). The ATA and APP further claim that beyond smallholder farmers, limited access to financial services also has adversely impacted input suppliers, crop processors and traders, and other private sector firms engaged in agribusiness value chains and in agriculture more broadly. According to the APP, insufficient access to credit and insurance products, high interest rates, and non-recognition of cooperatives and farmer-based organizations by financial institutions are among the major constraints to agricultural financing in Nigeria.

As a result, several policy interventions, such as the Nigerian Incentive-based Risk Sharing System for Agricultural Lending (NIRSAL) (2011); the Growth Enhancement Support Scheme (GES) (2012), and the Anchor Borrowers' Program (ABP) (2015), were instituted by government to mitigate the problem. Yet, access to agricultural credit remains a major challenge for smallholder farmers and others involved in the agri-food value chains in Nigeria (World Bank, 2022). Lending organizations are largely constrained by the unique risks in the sector, high transaction costs often associated with dealing with large number of smallholder farmers, and micro, small, and medium enterprises (MSMEs) that dominate the agri-food

value chains. According to the Enhancing Financial Innovation and Access (EFInA) nationally representative survey data (EFInA, 2020), of the 38 million financially excluded adults in Nigeria, 81 percent of them are from rural areas. On the other hand, there is limited effective demand for finance by agri-food value chain actors because of their inability to meet the often-demanding requirements such as inadequate collateral and risk-averse behavior of smallholders (Balana et al., 2022).

Furthermore, informal sources (especially borrowings from family and friends) dominate rural credit in Nigeria as only 2 percent of rural dwellers have accessed credit from formal financial institutions (Table 1). In terms of savings, the EFInA (2020) data show that only about 56.1 percent of rural dwellers reported some savings, but most of these savings are held through informal or traditional means. Regarding physical access to financial institutions, only 38 percent of rural adults are within proximity to financial access points/ service providers, of which many of the access points (84 percent) are operated by financial service agents (EFInA, 2020). The financial gap (both credit and savings) among rural smallholders on the one hand and the availability of the network of financial service agents on the other, presents a market opportunity for designing, promoting, and scaling digital financial services to agri-food value chain actors.

Table 1. Credit and savings behavior of rural households

Credit and saving characteristics	Rural	Urban	National Average
Credit behavior/attitude			
Credit (borrowed in the past 12 months) (%)	27.8	24.2	26.5
Borrow from formal institutions (%)	2.0	3.7	2.6
Borrowed from informal institutions Borrow informally (%)	8.1	7.6	8.0
Borrowed from family and friends (%)	17.7	12.9	16.0
Did not borrow in the past 12 month (%)	72.2	75.8	73.5
Savings behavior/attitude			
Savings (saved in the past 12 months) (%)	56.1	68.2	60.3
Saved with formal institutions (%)	25.0	45.6	32.1
Saved with informal institutions (%)	31.1	22.7	28.2
Did not save in the past 12 months (%)	43.9	31.8	39.7

Source: EFInA Access to financial services in Nigeria, 2020 Survey

2.2.2 Key features of agricultural financial services in Nigeria

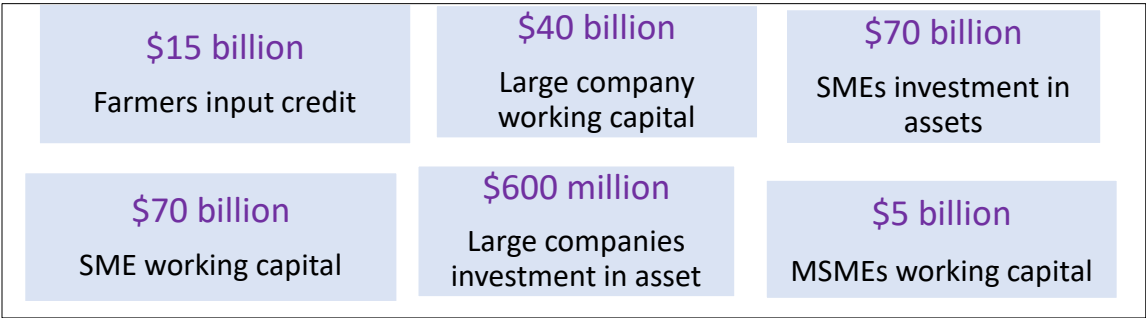
A) Wide gap demand and supply of agricultural credit

According to Agri-logic (2022) there is a wide demand-supply gap in agricultural finance in Nigeria (Figure. 1). Based on the demand-supply estimation, there is a 90 percent financing gap for agricultural finance in Nigeria. Demand for agricultural finance largely comes from farmers' short-term input financing, MSMEs' medium to long-term assets and overheads financing, and large companies' short-term working

capital and long-term investments in productive assets (Agri-logic, 2022). The demand for farmers’ input financing alone is estimated at \$15 billion while the total supply of agricultural finance is estimated at \$4 billion.

Weaknesses of the agricultural sector, lack of collaterals, uncertainty/risk inherent in agriculture, high transaction costs, and knowledge gaps are the key factors that explain the large financing gap in the sector. Other factors include corruption, policy inconsistencies, volatile security concerns specific to the rural economy, market volatility, weather, and supply chain risks.

Figure 1.Total demand for agricultural financing in Nigeria

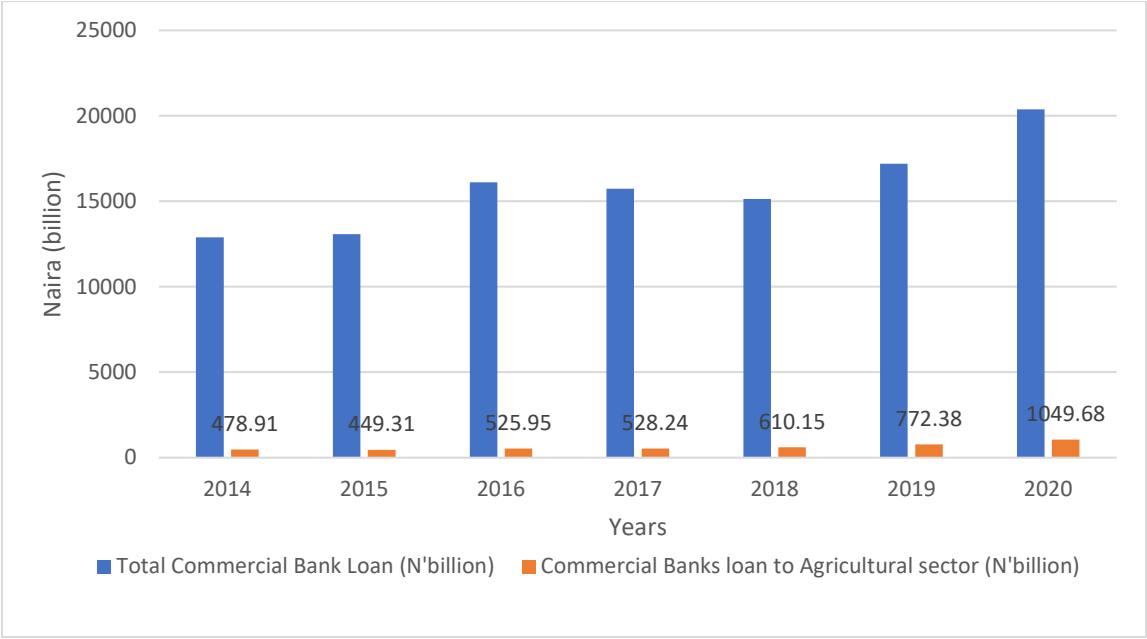


Source: Agri-Logic (2022)

B) Low agricultural lending from commercial banks

The agricultural sector accounts only 5 percent of the total loans from commercial banks. Data from the central bank of Nigeria (CBN) show that the agricultural sector received the least credit from commercial banks as compared to other sectors (Fig. 2). For instance, commercial bank credits to agriculture are at their highest level in seven years in 2020, and yet still less than 6 percent.

Figure 2. Commercial bank credits to agricultural sector (2014-2020)



Source: CBN; Authors' compilation (2022)

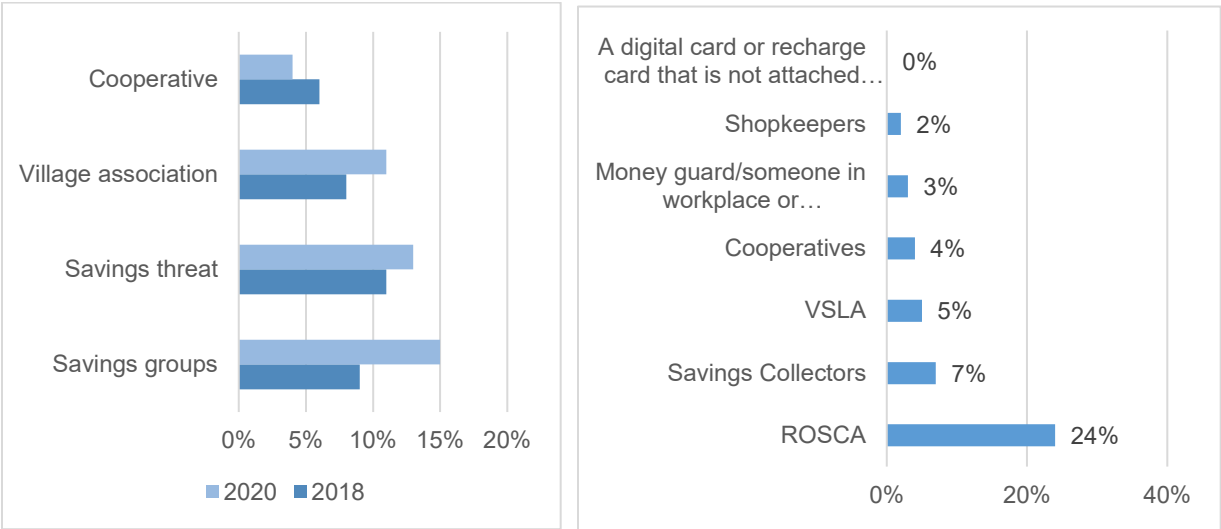
The bulk of constraints to commercial bank credits to agriculture comes from the often-demanding collateral requirements. At the same time, many banks also lack knowledge on lending to the agricultural sector, and hence experience difficulties growing their agriculture portfolio. This is in addition to bank branches being hardly accessible in rural communities, as most bank branches are mainly located in major cities (NBS, 2019). Other factors include high transaction costs, weak infrastructure to ensure credit delivery, corruption, policy inconsistencies, volatile security concerns specific to the rural economy, market volatility, weather and supply chain risks that often come with agribusiness globally (Agri-logic 2022).

C) Informal finance as an alternative to limited access to formal financial services

Informal financial markets—such as friends, relatives, neighborhood money lenders, local rotating saving, and loan associations (VSLA), and cooperatives—play a significant role in meeting the financial needs of smallholders and SME agribusinesses. This is because informal financial services do not require stringent conditions, for instance, no collateral requirements compared to formal financial services. The advantages of easy accessibility, flexibility in interest rates and repayment periods, low administrative and procedural costs, little or no collateral, and flexibility to operate in heterogeneous markets are all used by informal financial market services to operate in a variety of markets and provide a range of services. Rural areas are home to many informal financial institutions, making them readily accessible to rural farmers who view these organizations as a convenient source of funding (Henri-Ukoha et al.,2011;

CGAP, 2017; EFINA, 2020). Between 2018 and 2020, the number of adults using informal financial services increased by 5.3 million (Efina, 2020). This steady rise in the general uptake of informal financial services is mainly driven by the increasing contribution of savings groups, savings thrifts, village associations, and cooperatives which have sprung up across both rural and urban economies. Within this period, savings groups witnessed an increase of 7 percent, savings threat 2 percent, and village associations 3 percent, while cooperatives contributed to the growth by 2 percent (Figure 3 (a)).

Figure 3. (a) Growth of informal financial services; (b) Informal financial service use by smallholder farmers



Sources: (a) EFINA Access to financial services in Nigeria, 2020 Survey. (b) CGAP National Survey of Smallholder Households in Nigeria, 2017

As shown in Fig. 3(b), informal sources of financial services such as ROSCA, savings collectors, VSLA, and cooperatives have been found to be more popular with smallholder farmers. ROSCAs represent about a quarter (24 percent) of informal financial services used by smallholder farmers in Nigeria.

D) Growing Microfinance Institutes (MFIs) but limited coverage to smallholders

The services of MFIs have grown since the Central Bank of Nigeria (CBN) adopted a microfinance policy in 2005 (CBN, 2005). The goal of the policy is to offer a framework for microfinance that will improve the delivery of diverse microfinance services for low-income and underprivileged populations over the long term. Though access to microcredits improves the productivity of farmers and contributes to uplifting the livelihoods of disadvantaged rural farming communities (Nosiru, 2010; Ogebe et al., 2021), smallholder farmers still face some constraints in accessing microcredit (World Bank, 2017) due to lack of information, high-interest rates, and inadequate supply of credit institutions as well as risk-averse nature of some

farmers (Anang et al., 2015; Ogebe et al. 2021). However, MFIs reach is relatively small (estimated at 1-10 percent of the total target population), and MFIs also prefer urban areas (World Bank, 2017).

2.2.3 Government schemes/programs in the agri-food sector finance

To address the limited financing to agriculture by banks, the FGN through the CBN in the last three decades has been involved in the design and implementation of various schemes and programs. The Bank of Agriculture (BOA), the Bank of Industry (BOI), Nigerian Agricultural Insurance Company (NAIC) and the Agricultural Credit Guarantee Scheme Fund (ACGSF) are key government institutions established to address limited financial access by smallholders. The ACGSF, for instance, has provided a guarantee to deposit money banks (DMBs) for loans to small and medium-scale farmers in the country. Other policies such as Rural Credit Schemes (RCSs) aimed at increasing and sustaining lending to agriculture mandates commercial banks to open rural branches across the country were instituted.

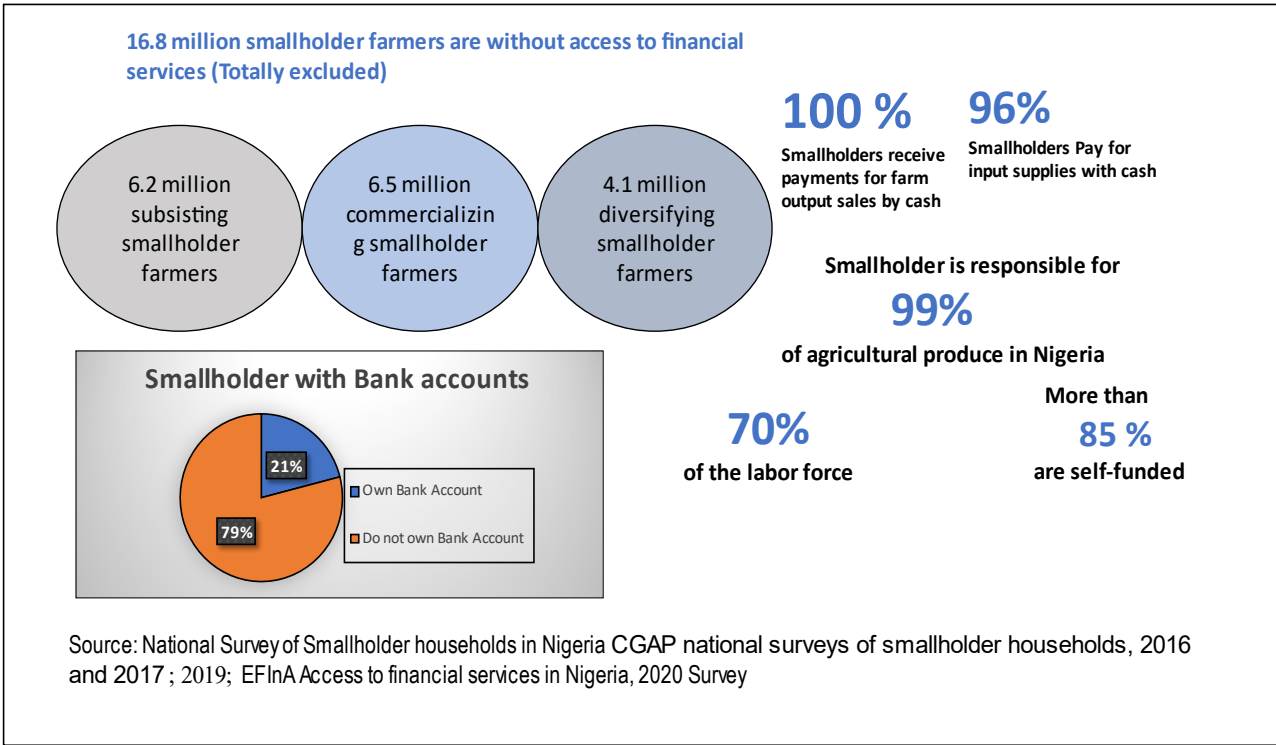
The Anchor Borrowers Program and the establishment of the Nigeria Incentive-Based Risk Sharing System for Agricultural Lending (NIRSAL) are recent government attempts to address smallholders' access to credit. For instance, through its Anchor Borrowers Program the CBN releases about ₦100 billion annually to aggregators (private companies, commodity associations, input suppliers, and state government) who in turn provide financing or input credit to farmers (CBN, 2018). Studies show that programs such as the Anchor Borrowers Program and NIRSAL have positively impacted production, productivity, and supply volume (Olanrewaju et al., 2020; Udoh and Adelaja, 2021)

2.2.4 Smallholders and digital financial services (DFS) in Nigeria

A) Cash is a dominant instrument in payment and receipts among smallholder farmers

Cash is still a key instrument in use by smallholder farmers despite several initiatives by social enterprises and groups to digitize payments along the agri-food value chain (Fig. 4). Many smallholder farmers still buy agricultural inputs with cash and get paid with cash for their produce. Since access to financial service outlets in rural areas is still limited, smallholders are mostly put off by transaction costs and travel charges. Almost all smallholder farmers pay in cash when they buy agricultural inputs including seeds, fertilizer, and insecticides. For instance, an estimated 96 percent of Nigerian farmers paid cash for their inputs. In a similar vein, none of the farmers get paid for their farm income through digital channels; according to reports, of all the farmers are paid in cash (EFInA, 2020). These challenges however underscore the need for collaboration among agricultural social enterprises, DFS providers, and agricultural buyers to ensure farmers can be effectively served better.

Figure 4. Key features agri-finance services among Smallholder farmers in Nigeria



Source: EFINA Access to financial services in Nigeria 2020 Survey

B) Inadequate access to the internet and low level of digital literacy

The use of digital solutions by smallholders has been constrained by low levels of digital literacy and limited internet connectivity. The internet is unavailable to 70 percent of smallholders. The large digital literacy gap might make it difficult for people to employ digital solutions since it prevents them from using various digital financial services.

C) Smallholder farmers are willing to adopt trusted digital solutions

Despite their low digital literacy with marginal investment in capacity strengthening activities (trainings), studies show that smallholder farmers are likely to adopt digital financial services (Mercycorp, 2021). Farmers can expand on how they utilize their mobile phones. About 81 percent of farmers have a kind of digital identification, such as a voter's card, which enables them to access banking services. About 77 percent of farmers use mobile phones (CGAP, 2019). As of 2021, a local agri-tech company called 'Crop2Cash' offered digital financial services to farmers. According to Crop2Cash, about 400,000 farmers from all over Nigeria have been registered on the company's digital platform, with women making up 39 percent of all farmers. Another innovative agribusiness firm called 'Agrorite' provides smallholder farmers with access to funding, advisory services, and premium markets. Similarly, Pula Ltd., an agricultural insurance and technology company that designs and delivers innovative agricultural insurance and digital

products to smallholder farmers to insure yield risks, improve their farming practices, and bolster their incomes over time has worked with the Central Bank of Nigeria to provide insurance for over 543,000 farmers loans in all Nigerian states. However, scaling the adoption of DFS will depend on the ability of social enterprises to train farmers on the use of DFS, as well as ensuring their awareness of the suits of DFS services available. Farmers generally do not have access to information on improved agricultural technology, 69 percent of farmers rely on friends and family for advice on agricultural activities and mainly (CGAP, 2019).

3. EMERGING LOGISTICS AND DIGITAL FINANCE SERVICES (DFS)

In this section we present the emerging logistics and digital financial services along the nodes of agri-food value chains in Nigeria.

3.1 Emerging logistics services

As discussed in the previous sections, the fragmented nature of input and output supply chains in Nigeria is an inherent constraint to their effective operation. When smallholder farmers are in remote communities and operate individually, access to affordable logistics services (such as transportation and storage), low-cost finance and information (on markets, technologies, etc.) can be difficult. In some cases, these farmers simply lack information about existing innovations. In other cases, they are aware of the available innovations but the effective price of accessing those innovations and/or selling the output generated from their use are too high and low (respectively). In this context, better coordination of activities in the midstream and downstream of the input and output supply chains can significantly improve the operations of many agri-food supply chains. Improved coordination (via links to guaranteed input supply and output market with input delivery services and output pick up services) increases the ability of farmers to access various inputs and services at lower costs and get higher effective prices for their products. For large-scale processors and other market channels, improved coordination can guarantee them high quality produce at scale with information on production and handling practices that can be used to access specific niche markets that are willing to pay for certain product attributes. This can be passed on to farmers through improved access to modern market channels and associated price premiums, which could then improve the incentives for them to adopt yield enhancing technologies and practice.

Over the last decade, there has been a rapid expansion of private-sector enterprises (largely small and medium scale enterprises) that provide farmers with these sorts of coordination services. These SMEs often offer farmers a suite of services to support their delivery of products by supporting farmer engagement in input and output markets (Liverpool-Tasie et al., 2020). These services include input provision and delivery, training, credit, and a guaranteed market and pick up services. The provision of this suite

of services addresses idiosyncratic market failures and asset shortfalls of small-scale producers and are viewed as potential mechanisms to foster more inclusive food systems. These services reduce the transportation costs associated with input purchases and output sales (and thus the effective prices faced by farmers) and can potentially fill gaps in what small-scale producers require to undertake beneficial transactions such as the adoption of modern technologies and the production of sufficient volumes of high-quality products to secure available premiums previously out of their reach. Table 2 presents the major agri-food value chains logistics services providers identified in this report.

Table 2. Logistics services providers in agri-food sector in Nigeria

Which node of the value chain?	Names of service providers and their key services
<p>Midstream and downstream (refrigerated and non-refrigerated transport service)</p>	<p>(1) Red Star Express Plc. is Nigeria's leading logistics provider with over 150 offices in Nigeria that services 1500 communities. Red Star has 4 subsidiaries one of which offer Agro-logistics specialized services for movement of agricultural produce.</p> <p>(2) APM Terminals Kano offers a refrigerated truck transport service to help farmers get more perishables to market with less spoilage. As part of an ongoing investment in cold-chain solutions in Nigeria, APM provides modern cold chain transportation alternatives for farmers in the agricultural centers of northern Nigeria to bring fresh produce intact and unspoiled to market centers in Lagos.</p> <p>(3) Kennie-O Cold Chain Logistics (KCCL) is a SME based in Ilorin, Kwara State that provides refrigerated transport and cold storage solutions to fresh agricultural products (fruit and vegetables) as well as the pharmaceutical industry.</p> <p>(4) Awesome Fresh is a SME based in Jos, Plateau that also provides refrigerated transport services to farmer associations and retail food operators. The company also operates as an aggregator of agricultural products.</p> <p>(5) NARTO (National Association of Road Transport Owners). The association comprises all commercial vehicles owners in Nigeria engaged in haulage of products, general cargoes, and passengers, within the country and the entire West-Africa sub region.</p> <p>(6) Mile 12 Traders association is an influential association representing traders (at Mile 12 international market in the city of Lagos)</p>
<p>Midstream and downstream (warehousing and cold storage)</p>	<p>(1) AFEX is a commodity exchange organization that aims to facilitate trade in Nigeria and other African countries by deploying an efficient market system. They have programs geared to link farmers to both input and output markets.</p> <p>(2) Cold Hub is a business enterprise that operates solar powered walk-in cold rooms for its clients. Cold Hubs offers customers a flexible pay-as-you-store subscription model. Clients can have their perishable foods put into reusable crates, which fit neatly onto shelves in cold hub storage units and pay a daily flat fee for each crate.</p> <p>(3) OTACCWA (Organization for Technological Advancement of Cold Chain in West Africa), is a multi-disciplinary and multi-sectoral group of professionals, companies and organizations in Nigeria and ECOWAS countries with the primary mission to organize the</p>

	different industry sectors participating in the cold chain supply of perishable commodities and products, medicines for storage, and transportation or distribution.
Indirect logistics services (either in-house as complementary service or rented in or facilitator)	<p>(1) Kobo360 is a long-haul e-logistics business to business (B2B) platform utilizing an “Uber for trucks” model to develop a marketplace matching cargo owners with long-haul freight needs and truck owners who can service them. Through its internally developed digital platform, Kobo360 is disrupting the transportation and logistics market in Nigeria offering a strong value proposition to key stakeholders in the sector including cargo owners, transporters (and drivers), and cargo recipients. Kobo optimally matches demand and supply of trucks, providing predictability, reliability, price transparency, and increased utilization of otherwise idle assets in the highly fragmented trucking market in Nigeria.</p> <p>(2) Trade Depot is an innovative platform of Business-to-Business services delivering consumer goods to retailers in urban and peri-urban communities. Trade Depot enables factory-to-retail distribution for consumer goods companies such as Danone, Unilever, Kellogg’s, Indomie, Nasco, etc (https://www.tradedepot.co/). The company serves a network of about 100,000 retailers. In addition, Trade Depot provides micro-loans to retailers to enable them buy more of their products, backed by financial institutions. Trade Depot has operation in Nigeria (5 states), Ghana, and South Africa.</p> <p>(3) KariGo is a technology-based solution platform that connects a Cargo owner with a truck owner with the help of the KariGO mobile app. The platform brings all together: cargo, trucks, technology, speed, innovation, and savings. Cargo owners include corporate cargo owners (FMCG, courier, shipping, and manufacturing companies) or individuals and one-off cargo owners.</p> <p>(4) Intriosynergy is a business enterprise that works with thousands of smallholder Nigerian farmers involved in soybean and sorghum production. The company serves as a one-stop-shop that provides numerous services that bridge the gap between smallholder farmers, providers of various inputs and services to farmers and agro-processors who require significant quantities of the farmers’ output but often experience inadequate supplies both in terms of quantity and quality.</p> <p>(5) We move Tech is a business that provides transportation services of all kinds (including for food) in Nigeria. Through a logistics asset partnership scheme, they also provide opportunities for the management for vehicle owners who want to engage in logistics.</p> <p>(6) Sabi and Vendease established in 2020, have created digital marketplaces allowing wholesalers, shopkeepers, restaurateurs, and hotels to buy directly from farms and manufacturers (Reuter, 2020).</p> <p>(7) Kitovu is an agricultural-focused technology company uses data to eliminate agricultural supply chain inefficiencies. Kitovu adopts a market-driven approach to connect farm produce to end consumers. The company creates relationships with major buyers and accesses information from them on what crop varieties they prefer and possible quantities they procure. Kitovu offers a blend of products and services including commodities supply service (e-Procure), fertilizers, seeds, agrochemicals, and an input finance scheme.</p>

These platforms themselves (and their provision of these suite of coordination services to address existing market failures) could be considered as an innovation within agri-food value chains. The identified

private sector SMEs providing coordination services along food value chains (Table 2 below) have several advantages over other existing mechanisms that could provide similar coordination services (e.g., cooperatives, farmer groups and large scale agro-processing companies via out grower schemes and other contractual agreements). (i) They are usually formal companies thus have better access to formal credit at lower interest rates. This facilitates their ability to make necessary investments such as the purchase of fertilizer at scale, purchase and management of storage units, purchase of irrigation equipment and training private extension service delivery. Access to formal credit can also support these SMEs to further coordinate credit supply to their farmers. (ii) They have better social capital compared to the large formal (and usually export oriented) agro-processors operating with contractual out grower schemes. This facilitates more sustainable interactions and lowers risks of side-selling and credit default by clients. (iii) They are typically located closer to farmers and thus have lower transaction costs for reaching out to smallholders and more remotely located farmers (and their associated coordination costs) and thus offering this additional delivery service that addresses the last mile problem for farmers. (iv) Farmer groups and cooperatives have been documented to have mixed impacts on farmers and their level of formality varies significantly. While highly successful cooperatives have been instrumental for price negotiation and coordination of product supply in some value chains, numerous cases of poorly functioning cooperatives exist. This is often due to poor management skills, technical deficiencies, a perception among members that these groups have a primarily social objectives, and internal power dynamics.

The majority of the above problems can be avoided by these SMEs that are primarily profit seeking businesses willing to provide the required services because they perceive a mutual benefit to them and their clients. Thus, they represent an alternative model for reducing coordination failures to using logistic services in agri-food value chains. Understanding the efficiency with which these SMEs provide coordination services can inform on the need for supporting their use of more formal logistic services (because of the economies of scale they provide through their aggregation activities) that could increase the ability of farmers and the SMEs to provide traceability and information about their projects through a more structured collaboration with other formal logistics service providers (e.g., kobo 360). In this regard, a significant improvement could also be made in upstream operations using software such as Capture Solution that could enable the SMEs to map farmers' production, weight and track it. Moreover, the SMEs could promote the use of technologies such as hermetic storage bags that could address post-harvest losses for grain (cereals and grain legumes such as cowpea) which represent a major impediment for food and income security for many farmers.

As Nigeria experiences a rapid urbanization, neighborhood shops and vendors can become an important food outlet. Though these outlets account for a large share of the food supply in urban and peri-urban areas, they are not well understood. In many instances, the range of products available are limited and

the prices are higher due to the high costs associated with product purchase and delivery. In response to this a start-up called TradeDepot has developed a successful business model to deliver products to the retail market in urban communities. TradeDepot's innovative model addresses the inefficiency in transport services and the coordination of product delivery to the retail market segment. Like Amazon Prime, TradeDepot connects the retailers in urban neighborhoods to a large suite of consumer products. In fact, TradeDepot enables factory-to-retail distribution for consumer goods companies such as Unilever Nigeria plc., Danone, Kellogg's, Indomie, and NASCO group. TradeDepot serves a network of about 100,000 retailers, more than 75 percent of whom are female entrepreneurs. TradeDepot's App platform gives these small retailers a real time view of all prices and discounts available from every major brand. They can order products directly, which are then delivered to them within 24 hours, with the order routed to the appropriate nearby depot. At the same time, manufacturers have full visibility over their distribution and can leverage the platform to optimize deliveries to their distributors, improve their pricing and have a direct channel towards their end-retailers. In addition, to help retailers grow their businesses, TradeDepot has developed micro-loans to enable them to buy more products, backed by financial partners. TradeDepot is active across 10 cities in Nigeria (and 5 states). Although the business model has expanded rapidly over the past 6 years, it is currently limited to manufactured goods.

3.2 Emerging digital financial services (DFS)

Digital technologies are advancing access to finance and closing the financial inclusion gap in many developing countries (CGAP, 2014). For instance, the inclusion of mobile money accounts in the World Bank's 2014 Global Findex is attributed in part to narrowing the financial inclusion gap from 2.5 to 2 billion people. According to the 2014 Global Findex database, 700 million adults worldwide became account holders between 2011 and 2014; a 20 percent drop in the number of adults without an account – the 'unbanked' (Demirguc-Kunt, et al., 2014). Where brick-and-mortar branches of banks, insurance companies, lenders, and other financial services are unlikely to ever penetrate, DFS can penetrate it and serve as alternative means to provide financial services. According to Mckeyson (2017), the adoption of DFS can potentially boost the annual GDP of all emerging economies by \$3.7 trillion by 2025. Between 2018 and 2019, active adult DFS users increased from 16 percent to 28 percent.

With the limitations of agricultural financing and the growing adoption of digital technologies, accompanied by the increasing penetration of broadband mobile network coverage, several initiatives aimed at addressing the gaps in accessing financial services along the agri-food value chain are now being developed. Digitized data, when available, provide the necessary analytical base for developing customer-focused products and risk evaluations that can aid in the extension of credit and other financial services. DFS towers above conventional finance in its ability to effectively assess risk, lower costs, and swiftly deliver financial services.

3.2.1 Emerging private sector-led initiatives in DFS in the agricultural sector

Motivated by the relative success recorded in the nonagricultural context, many private sector led initiatives are now exploring various dimensions of the potential of DFS in delivering financial services to the agricultural sector, particularly smallholder farmers and agri-food SMEs.

A) Credit/ loan disbursement – Examples of emerging private DFS in agri-food credit in Nigeria include Agrorite and Crop2Cash. Agrorite is an indigenous Agri-tech company that provides smallholder farmers with finance, inputs, and profitable market linkages. The company developed a technology platform and a customized wallet which has largely helped in digital service deliveries to the farmers. Similarly, Cash2crop, an indigenous digital-financial services provider, enables smallholder farmers in rural Nigeria to receive digital payments and build their financial identity. Cash2crop has over 400,000 registered farmers in their database and partners with commercial banks such as First City Monument Bank to support farmers' access to financial services, and input providers such as SARO Africa to extend input delivery to farmers, leveraging their vast agent network spread across 30 states of Nigeria to bridge the technology uptake gap among farmers. The agents engage, enroll, and train the rural farmers on the use of Cash2crop digital-financial services. The agents train the farmers on using Crop2cash Mobile apps, Unstructured Supplementary Service Data (USSD), and other technology-related instruments. The digital financing tools ensure farmers can provide data required against which they are assessed, and loan decisions made.

B) Credit scoring - Financial service providers and emerging third-party providers are now using data generated from users' interaction with digital financial tools to develop credit scores. With the growth in the use of mobile money subscriptions, the number of individuals with credit scores has also increased. The new innovative credit scoring mechanisms, in essence, have promoted automated lending and reduced the cost of lending. Alternative digital credit scoring methods are also gaining traction, as a means of facilitating access to financial services (Mercy Corp, 2022). Social Lender (Social Rep.) in Nigeria offers DFS, based on credit scores generated from social reputation. Social Lender is an indigenous financial solution provider that bridges the gap between people's immediate access to formal financial services. Social Lender credit scoring is based on social reputation either on mobile, online, offline, or social community platforms. Users can provide their data via mobile Apps, USSD, website, and SMS and uses its proprietary algorithm to perform a social audit to generate a User's Social Reputation Score. Users can then access services from banks and other partner institutions. The digital-based credit scoring provides an efficient alternative to traditional forms of collateral. Applicants allow access to various data points including their contact information. Social contacts, when validated, can in turn serve as a guarantor, as they can potentially help to guarantee a portion of the loan (CGAP, 2019)

C) Payments/mobile money - Digital payment products including mobile money and card-based products are also pushing the frontiers of financial service provision. They are fast replacing cash-based forms of transaction with data generated from such transactions forming the basis for building other digital financial service products. Mobile money can leverage the high interoperability in the fintech industry to successfully drive the uptake of DFS. It has yet however been unable to fulfill this potential and is instead characterized by slow adoption, with only 1.7 percent of the Nigerian population using mobile money. MercyCorp (2021) estimated that only 4 percent of smallholder farmers own mobile money. Sterling Bank's Ag-tech platform SABEX, provides a blockchain-based trading and financing platform that allows actors to tokenize commodities and cash and facilitate exchange irrespective of where the farmer is located. The platform settles payment for both parties and the money gets into the wallet of the trader within minutes, in contrast to prevalent arrangements where commodities traders wait for several days before getting their commodity sold. SABEX also comes with an electronic warehouse receipt that helps to track when deposits are made, and the quantity of deposits made into the commodity warehouse.

D) Savings - Emerging organizations are now digitally replicating processes of several informal financial services such as village savings and loan accounts (VSLAs), linking them to formal accounts and ensuring a wider group of people is better served. The Sterling Supa Agro savings account allows smallholder farmers, members of farmers cooperatives, agro-input dealers, and other agri-food value chain actors to save and subsequently use their savings as security to access loans. The DFS product strengthens the culture of savings among agri-food value chain actors, particularly smallholder farmers, and helps them increase their access to financing through their savings held.

E) Insurance – The agricultural insurance market in Nigeria is largely dominated by the government with few private actors, who also face slow uptake of their services. For instance, only 2 percent of farmers currently have insurance (MercyCorp, 2021). To mitigate this low uptake, the government offers subsidized insurance often bundled with bank loan products. On the other hand, social enterprises are facilitating the integration of digital technology to mirror the processes and features of insurance for farmers. Insurance providers now leverage digital technologies and satellite imagery to provide weather-based index insurance to farmers. For example, Pula Ltd. an Agri-tech insurance company, delivers innovative digital products to help smallholder farmers mitigate and endure yield risks. Pula provides an insurance cover that can be bundled with farmers' input purchase, and send agronomic tips to farmers' mobile phones to help improve their farming. They also, amongst others, developed a USSD to deliver information to farmers in a way to understand insurance as well as for farmers to make the insurer aware of the incidence of loss. Instruments such as index-based insurance can potentially incentivize farmers to become less risk-averse, and instead take initiatives towards more profitable investments (Karlan and others 2012b, Mobarak and Rosenzweig 2012)

F) Crowdfunding/working capital—Crowdfunding is not a new fundraising method and harnesses the power that the internet has afforded. It provides start-ups and social entrepreneurs a platform to tap into the financial resources of the crowd. Start-ups like Thrive Agric and Farmcrowdy Ltd. are leveraging technology-enabled platforms to empower the middle-class to invest in farming. Through these crowdfunding platforms, investors can fund farming as low as \$200 to \$750 for a production cycle, usually reflective of the crop gestation period. The reward for the investors is a share of profit in the form of a guaranteed return on investment. Farmcrowdy Ltd. is a leading crowdfunding platform in the agribusiness sector, and as of 2019 was said to boast about 42,132 farm sponsorships (crowdfunded) and 11,124 farmers who are predominantly small holders. Other notable platforms include Imeela, donate-ng, e-farms, and Farm-ignite, among others. Similarly, start-ups such as Zowasel are partnering with organizations such as VFD Microfinance Bank to provide access to working capital to qualify crop sellers on their platform. Crop sellers with signed crop seller agreements with Zowasel and who meet the lending requirements of the digital bank can loan to finance their agribusiness.

3.2.2 Government-led initiatives in DFS

The Growth Enhancement Scheme (GES), an e-voucher scheme that was implemented across Nigeria in 2011, served as the Federal Government of Nigeria's first significant effort to provide agriculture with public sector-driven digital financial services. The initiative gave private agro-dealers the institutional support they needed to help farmers receive subsidized inputs (fertilizer, better seeds, and extension services). In essence, GES uses e-wallet mobile technology transfer to enable the direct provision of subsidized fertilizer from the government to the farmers, devoid of any intermediary, many of whom in previous times used fraudulent documents to obtain subsidized fertilizers from the government and resell at going market rates to the open market. The program was carried out through cooperation between the FGN, state agriculture ministries, and supply chain managers (SCMs), and the platform builder—Cellulant was designed to enhance agricultural productivity through timely and efficient delivery of yield-enhancing input (FRN, 2013). Through the program, enrolled farmers can redeem their inputs (fertilizer and seeds) from agro-input merchants using e-wallet coupons.

Government led DFS initiatives if well harnessed may potentially become the fulcrum for delivering public databases, which would allow the private sector to deliver DFS, while also providing the government opportunity to monitor their actions. Government-led initiatives such as its partnership with AFEX in 2014 to develop a warehouse receipt system have also indirectly contributed to scaling DFS. Arising from its partnership with the Federal Ministry of Agriculture and Rural development (FMARD) to enable small-holder farmers and cooperatives to store their produce safely at approved warehouses and use the receipts as collateral for loans (GSMA, 2022), AFEX has emerged as a leading warehouse receipt service provider in Nigeria today. AFEX built on the success of the program to become the first Nigerian licensed

private commodities exchange platform, driving capital to build a trust economy in Africa's commodity markets, while also providing solutions in trading, financing, and market development systems.

4. CURRENT CHALLENGES AND OPPORTUNITIES – LOGISTICS AND FINANCIAL SERVICES

In this section we will present findings from our assessment of the challenges and opportunities of agri-food logistics and financial services provisions in Nigeria. We use the strengths, weakness, opportunities, and threats (SWOT) approach to summarize the information and data obtained from a literature review, stakeholder consultations, key informant interviews, and observations/field visits.

4.1 Cross value chain logistic services

A summary of the potentials and challenges of agri-food cross value chain logistics services are presented in tabular form. This is followed by the detailed descriptions of each item in Table 3.

A) Strengths

- **Large and growing demand for transport services** - Food items need to be transported from the production areas to markets and processing centers. In Nigeria production of some agricultural commodities such as vegetables and fruits are concentrated in some states (e.g., Kano, Kaduna, Benue, and Plateau) and major markets are the big cities/towns in central or southern Nigeria (e.g., Lagos, Abuja, and Port Harcourt). This has resulted in high demand for hired transport services by agri-food supply chain actors. For example, in a survey of maize farmers, maize traders and animal feed mills in Nigeria, it was found that 72 percent, 80 percent and 95 percent of those farmers, traders and feed millers respectively who delivered their products to a buyer used hired transportation services (Liverpool-Tasie et al., 2021). However, the high cost of transportation remains a key constraint to the effective operation of food supply chains in Nigeria. This constraint was consistently highlighted by value chain actors of all sizes and across all nodes of the food supply chain (production, processing, and distribution). While transportation of food, generally, is confirmed to be a major constraint, this challenge is particularly faced by the value chains for perishable products such as fruit and vegetables. A majority of the innovations observed in transportation logistics (e.g., coordination and back-hauling) appear to dominate in the non-perishable consumer good sectors (final processed goods and grain). Interactions with stakeholders in CVC logistics services yielded interesting insights that could be the basis for innovations in this space. For example, insufficient appropriate means of transportation for perishable products; especially for temperature-controlled storage during transportation. The 11 million metric tons of fresh fruits and vegetables moved across cities in Nigeria every year would need a minimum of 25,000 trucks. But the industry records fewer than 1,000 cooling trucks (Murungi, 2021). The co-existence of growing demand for affordable and appropriate transportation

as well as storage facilities alongside insufficient provision in the subsector is an opportunity for interventions in transportation and storage that can have a huge impact on the operations of key value chains and food supply chains in general.

- **Existence of associations/ organized groups in several value chains.** The existence of professional associations/groups creates a potential mechanism for working with these constituents either directly (e.g., farmers and traders or truckers) or to link them with SMEs operating in the logistics space and whose service provision requires economies of scale. This does not ignore the challenges associated with groups and group dynamics (e.g., group management and inclusivity) but points out an important existing structure in many value chains in the Nigerian agri-food system and a potential mechanism for co-creation of interventions.
- **Growing demand for adequate volumes of agricultural products by actors in the midstream and downstream.** Numerous agri-food enterprises in the midstream and downstream of food supply chains need an adequate volume of quality agricultural products (as inputs for their activities). These enterprises appear to be interested in strategies to support their increased access to agricultural products at appropriate quantities and of sufficient quality from farmers and not always able to provide this support themselves. This creates an opportunity for interventions or other SMEs engaged in aggregation that can also make the provision of logistics services upstream more economical.

B) Challenges

- **Limited storage facilities and inappropriate handling techniques** for agricultural products in Nigeria has resulted in high post-harvest losses, poor food quality and undersupply of agricultural products, all these have continued to threaten food security in Nigeria. The increase in post-harvest losses of farm produce remains a challenge to Nigerian farmers due to inadequate storage facilities. Most farmers in rural areas only have access to traditional structures for storage. Poor handling practices crush tomatoes, expose maize to pests, reduce the pre-frozen life of catfish, and increase the likelihood of foodborne illness implicating pathogens (World Bank, 2020). The use of poor packaging materials (such as raffia baskets) during transport is a major cause of food loss (particularly perishable products). A recent study found that switching the storage of tomatoes during transportation from traditional baskets to plastic crates reduced losses from around 41 percent to as low as 5 percent (Olusola *et al.*, 2019).
- **Insufficient cold chain logistics** - Nigeria faces significant risks due to a lack of access to cooling fans, refrigeration and other forms of cooling that can protect food, among other benefits (World Bank, 2020). A reliable and efficient cold chain system will not only help to significantly reduce the losses in the quality and quantity of fresh fruits, vegetables, and proteins, but it will also improve the efficiency of supply chains and help to deliver safer and more nutritious foods to consumers (GAIN, 2018). It is

estimated that 37 percent of Nigerian agricultural production requiring refrigeration is lost due to inefficient or non-existent cold chains (World Bank, 2020).

- **Poor condition of vehicles used during transport** such as overloading of trucks and inadequate refrigeration or temperature control for perishable products.
- **Lack of proper coordination, transparency, and traceability.** One of the main challenges in many value chains is the lack of proper coordination, transparency and traceability of actors and products at each node of the chain. Despite the advent of services provided by new start-up companies, coordination failure persists and many SMEs struggle to provide/create a better ecosystem for their activities within the agri-food system. The lack of an appropriate traceability system to monitor truck movements and more generally coordination failure to identify available transportation services in a given location were two related issues that the market players raised during the discussions.
- **Low technology adoption.** Supply chain industries globally have embraced emerging technologies like artificial intelligence, advanced analytics, the internet of things and conversational systems. Most of these technologies have not been fully adopted in the supply chain industry in Nigeria, despite their successes in other climes (PWC, 2020). The country logistics system and processes have not yet been fully synchronized with the necessary state-of-the-art technologies that are obtainable in similar industries in advanced societies. Such emerging technologies include, real-time fuel management systems, warehousing management systems, cargo management systems, communication, and information systems etc. (ITA, 2021).
- **Fragmented demand of services at the farm level limits** the delivery of logistics services to smallholder farmers. Individual smallholder farmers cannot afford some innovative logistics services. In some cases, the demand needs to be aggregated to reduce cost or create more incentives for the service providers.

C) Opportunities

- **Growing E-commerce distribution model:** The demand for innovative solutions to provide access to fresh produce at consumer's doorstep increased in the retail market (Agramondis, 2022). The food supply chains in Nigeria are already being enhanced by e-commerce companies such as Farmcrowdy, Jumia, Naijapride, and Konga.
- **Large and growing demand for digital services:** Mobile internet user penetration in Nigeria increased from about 21 percent to 37 percent just between 2018 and 2022 and is projected to get to about 50 percent by 2027 (Statista 2022). Similarly, Nigeria's tech space has continued to witness tremendous growth, particularly in the fintech category. This expansion in internet use and financial technologies increases the possibility for technology driven innovations along value chains. More

generally, the agri-tech sector in Nigeria is growing and shows potential to develop and apply digital smart tools for curbing losses and inefficiencies at various parts of the value chain from input supply to market.

- **Disrupters in the logistics sector.** The interest to improve the coordination of the logistic sector is increasing with the entrance of new market players that tend to provide a specific logistics service (e.g., “WeMove Technology” and “Kobo360” in the transport service) or coordinate the provision of multiple services (and intrio synergy) that could be potential partners for relevant innovations.
- **Growing number of supermarkets.** The emergence and growth of a middle class in Nigeria has fueled the proliferation of supermarkets across the country. According to the National Bureau of Statistics (NBS), the percentage of total GDP attributed to the wholesale and retail trade sector increased steadily during the early years of the second decade of the 2000s, accounting for 15.58 percent in 2011, 17.05 percent in 2012 and 18.44 percent in 2013 (Deloitte, 2022). This expansion of supermarkets has encouraged the changes in shopping habits, with agricultural and food products now being sold in the retail stores.
- **A large youth population:** A large youth population, many that are technology savvy, and energetic and seeking employment is an opportunity for the scale up of innovative logistics related services particularly low-cost technology driven interventions to support information access and coordination in the agri-food space. We note that many of the current strengths and weaknesses highlighted above create opportunities for the design of interventions to improve logistics service provision and access in Nigeria’s agri-food system. They also indicate potential partners for the research team to engage with to support the actors within the system that are already doing what is more likely to be sustainable in the long run.

D) Threats

- **Poor road condition during transportation:** Nigeria is said to have the largest road network in West Africa, with about 195,000 km of road network. However, as of 2019, only about 31 percent (or 60,000 km) are paved (LCA, 2019). The condition of most roads in the country are poor, mainly due to lack of consistent maintenance, and the use of poor-quality materials both during construction and repairs.
- **Insecurity situation.** The increasing insecurity in different parts of the country is also a problem for logistics operations in the country. There is an increasing number of kidnappers, bandits, robbers, terrorist attacks, and inter-communal clashes. This insecurity makes supply chain and logistics operations difficult in affected parts of the country as noted by majority of those interviewed. Adjusted practices (such as travelling during daylight versus overnight) seem to dominate with limited use of insurance due to high costs and insufficient insurance products available which could be something to explore further.

- **Poor electricity supply.** Electricity supply remains a key challenge in Nigeria's food system. In a study by Mather et al. (2022), electricity (power outages) was the most prevalent constraint to business operations cited by enterprises in the Nigeria World Bank enterprise survey. The study found that this challenge was particularly problematic for firms in the agri-food space as 66 percent of food M/S firms rated power outages as a major/severe constraint compared with 46 percent of non-food M/S and 37 percent of those in retail-wholesale. The importance of consistent power access for agri-food firms is related to their need for cold storage, given the perishability of fresh food items such as fresh meat/fish, dairy, and some vegetables, as well as for electric-powered machines used in food processing and packaging. Poor electricity supply has made it necessary for numerous businesses (particularly in the agri-food sector) to operate generators which increases their costs and reduces their profitability.
- **Rising cost of fuels.** Diesel prices that surged since Russia invaded Ukraine in February 2022 have been on the rise in Nigeria prior to the Russia-Ukraine crisis. Nigerian businesses generally rely on fuel because of poor and fluctuating power supply. High fuel cost has significantly increased transportation costs and is also eating into the profits of many agri-food enterprises. In an interview by the premium times, the former president (HE Olusegun Obasanjo) noted that higher fuel prices are eating into the profits of fish businesses in Nigeria and reducing the ability of domestically produced fish to compete with imports (Premium Times, Aug. 2022).

4.2 Cross value chain digital financial services (DFS)

A) Strengths

- **Growing adoption of mobile phones and penetration of broadband internet** - The growing number of mobile phone users and penetration of broadband internet has spurred the adoption of digital financial services. Mobile internet penetration in Nigeria increased from 20.74 percent in 2018 to 37.34 percent in 2022 (Statista 2022). With new models of delivering financial services such as mobile money and USSD also replacing the old ones, access to mobile phones and internet has become fundamentally useful to increasing the efficiency and effectiveness of customer's access to financial services and to reduce costs (Alshubiri et al., 2019; Asongu and Nwachukwu, 2019; Edo et al., 2019). Access to mobile phones and internet promotes information sharing on financial services and as a result increases financial access (Aminuzzaman et al., 2003; Asongu and Moulin, 2016; Asongu and Nwachukwu, 2019). The majority of the DFS innovation observed from our Key Informant Interviews (KII), relies on mobile phone access by actors and farmers. For example, the innovative way of using USSD by smallholder farmers to access credits and payments will rely on their access to mobile phones. Financial service providers leverage digital infrastructure like mobile phones and internet to drive the credit scoring mechanism of potential customers. The use of mobile apps to collect and

process data has also become an efficient alternative to the laborious documentation required for various operations that has contributed to the percentage of those who are financially excluded.

- **Access to large pool of data for effective targeting** - Digital technologies generally afford technology-driven organizations to offer embedded services. For example, some of the stakeholders we consulted said that they provide additional services such as market information, input purchase and price information to smallholders and actors, and as a result help them generate large pools of data that can help them better identify prospective users of DFS, and further develop more innovative products. Substantive impact in DFS is largely driven by the ability to leverage proprietary data, with the view of deriving new product insights. This enables organizations to accurately develop new products, targets potential customers, and consolidates relationships. Data insights also help DFS create effective scoring and evaluation algorithms to facilitate risk management, especially when lending and providing insurance to prospective customers (Mckinson, 2020)
- **Growing a viral network of agents in the agri-food value chain** - Between March and April 2020 alone, the banking sector sees a significant surge in agent banking transactions in Nigeria (Mckinson, 2020), with agents able to perform various transactions to consumers. In a similar vein, DFS providers operating in the agricultural sector are also adopting the agent network model to support digital financial service delivery to the rural economy. The agent network can help in driving awareness and education of consumers. In the case of farmers in the rural economy, the agents drive adoption, train and help farmers solve bottlenecks preventing them from using DFS. For example, the Cash2Crop (a digital-financial services provider that enables smallholder farmers in rural Nigeria to receive digital payments and build their financial identity) leverages its agent network across about 30 states of Nigeria to train smallholder farmers on the use of their mobile Applications and USSD solutions. Similarly, some DFS providers use extension officers with experience working with smallholder farmers to drive adoption of DFS, which significantly mitigates some market barriers to entry often faced by agricultural tech-startups working within the agri-food value chain. The existence of associations and groups alike also serves as a potential mechanism for driving the adoption of DFS along the agri-food value chain.

B) Challenges

- **Institutional barriers to entry** - The existing regulatory guidelines for DFS providers in Nigeria is not conducive to FinTech start-ups from applying for license to DFS operations. For example, the Mobile Money Services in Nigeria guideline requires anyone applying for a mobile money license from the CBN to provide evidence of having a minimum of N2,000,000,000 (two billion Naira) as its shareholders' funds, or roughly \$7,000,000 (seven million US dollars).

- **Lack of trust** - Despite the innovations in financial service delivery, many customers may still prefer to conduct their financial services in the traditional way. The traditional banking services are still considered safer despite DFS being faster and more efficient. DFS providers without well-known physical structure are more likely to be treated with suspicion. Many may be concerned with privacy and data security. For instance, to strengthen the trust, some DFS within the agricultural sector are forced to introduce pay-on-delivery for input purchase by smallholder farmers, which may result in additional financial and human resources costs to the providers.
- **Poor technology adoption** - The adoption of digital technologies integrated into agri-food value chains, has been generally poor. According to Mago and Mago (2015), ineffective knowledge exchange, information management, as well as limited institutional capacity has grossly contributed to poor adoption of technology. Other factors such as language barriers, poverty, and illiteracy have also served as major barriers to small-scale farmers adoption of digital technology in Nigeria (Nmadu et al., 2013). Poor adoption could also be linked to lack of technical competencies and lack of access to critical digital infrastructure (Odini 2014; Samii 2008). Adoption of new technologies may also take time. Small holder farmers may be reluctant to adopt DFS at the initial stages, and are most likely to adopt only after their perception has been impacted (Paudel et al., 2020)
- **Wide digital literacy gap** – The wide digital literacy gap is challenging to the use of DFS. This wide gap excludes many of the poorest from accessing suits of digital financial services. More than 50 percent of Nigerians are not digitally literate (World Bank 2019) but digital skills are essential to benefit from any technology across all sectors of the economy. According to Buckingham (2006), digital literacy revolves around a set of skills that enables individuals to effectively operate information retrieval tasks in technology-oriented environment.

C) Opportunities

- **Growing demand for digital services** - The Nigerian agri-food sector still potentially has lots to benefit from the growth in supply and adoption of DFS. The growth of DFS allows smallholder farmers, agri-food SMEs, and other digital entrepreneur to efficiently access various financial services. Also important is the Nigerian footprint as a regional and pan-African hub, which make it potentially positioned it to export its digital financial ventures beyond the borders of the country, and in the process diversifying its economy and fostering the regional integration within the Economic Community of West African States (ECOWAS) (IFC, 2017). With DFS, Nigeria can also boost its inward remittances from its vast diaspora network. DFS along the agri-food value chain can encourage and attract investment and exchange of human capital to the sector, a phenomenon that may significantly contribute to the needed transformation of the sector.

- **A large youth population** - A large youth population may serve as a potential fulcrum to scale up adoption of DFS. With over 65 million young people aged between 10 and 24 (World Bank, 2018), Nigeria has one of the largest youth populations in the world, who can potentially become an engine for economic transformation in Nigeria given the energetic and entrepreneurial nature inherent in them. Technologic savvy among the youths may help drive adoption of DFS in the rural economy through information and tech support access.

D) Threats

- **Cybercrimes and online fraud** – The long-standing war waged on online and financial fraud can potentially threaten the progress in the use of DFS. This is particularly a major concern among less educated users.
- **Increasing insecurity** - In the face of the ongoing struggle with terrorism and armed conflicts across the country, increasing regulatory control policies and oversight being put in place to stifle terrorism funding by creating checks on ease of obtaining instant credit may create fresh bottlenecks for the advent of DFS.
- **Limited and expensive access to national fiber-optic networks** - Access to national fiber-optic networks is still limited and relatively expensive where available. While there is considerable progress in the overall expansion of the network bandwidth across the country, the rural economy where the DFS services are most needed by smallholder farmers still have largely limited or no access to broadband internet networks. With very low-income levels among smallholder farmers, the competitively priced data products may pose threats to their ability (smallholder farmers) to adopt and use DFS in a meaningful way that can improve their productivity and well-being.
- **Weak digital infrastructure** - A stronger digital infrastructure remains critical to the expansion of DFS (IFC, 2017). The overall digital infrastructure of the country, on which digital financial services can thrive is still relatively weak. For instance, according to NIMC (2022), only 75.36 million Nigerians currently have a unique identity number, which means that more than 130 million Nigerians could still not be identified digitally. IFC (2017) noted that increasing investment in digital identification can potentially create opportunity for financial service providers to reach low-income customers with targeted and tailored financial services.

5. PROMISING LOGISTICS AND FINANCIAL INNOVATIONS FOR PILOTING

5.1 Innovative logistics services and potential partners

In collaboration with WP2 and local stakeholders, several innovative cross-value chain logistics service providers, and potential local implementing partners were identified. Table 3 provides the lists and descriptions of these logistics services and potential implementing partners. Of the lists in Table 3, the following three innovations (grey shaded in Table 3) in the areas of storage and transport services were suggested to be jointly implemented by WP3 and WP2 within the Initiative.

- (1) **Cold rooms service (Solar powered)** – This will be based on the existing IFPRI research and interventions. Cold storage services provided in rural markets are expected to have a significant impact for highly perishable food commodities such as dairy, seafood, fruits, and vegetables.
- (2) **Plastic crates (improved storage during transport) combined with business models** (clustered farmers). This will involve provision of plastic crates in rental arrangements bundled with market coordination services.
- (3) **Cool transportation**: This involves cooled transportation for fruits and vegetables in Nigeria to avoid post-harvest losses, allowing smallholders to achieve premium prices and consumers to obtain nutritious and fresh products.

Table 3. Innovations and potential partners for agri-food logistics services

Potential innovations	Justification and benefits	Potential partners ³
(1) Cool (refrigerated) transportation services	The important gap in the supply of refrigerated transport services is a major constraint to the effective delivery of fresh vegetable products from the producing areas in the North to large consumption markets in the South. Farmers and/or traders use transport system that results in important PHL. It is estimated that 40–50 percent of fresh fruits and vegetables are lost during crating, transportation, storage and processing in Nigeria. This intervention aims to provide refrigerated transport services in producing areas of fresh vegetables.	Awesome fresh, KCCL (this intervention can be combined with WP2)
(2) Plastic crates (improved storage during transport)	A simple technological solution such as transporting perishable products in plastic crates instead of woven baskets can contribute	-Crate manufacturers (e.g., CelPlast but see notes in Annex 1, or

³ The potential implementing partners listed in the third column of Table 3 are just temporary list, not the final list. The Initiative team and local partners are still under discussion on the modality and roles partners. There have not been final agreements between these partners and the Initiative's research team.

combined with business models (clustered farmers)	to reducing losses during transportation from 41 percent to 5 percent and delivers a monthly IRR of 34 percent over seven months (Olusola et al., 2019)	Holborn Nigeria Limited) -Crate service providers in Kano Bunkasa
(3) Cold rooms service (Solar powered)	The gap of refrigerated storage service is pronounced in rural communities where the overwhelming majority of smallholder farmers lack access to cold storage solutions. Cold storage services provided in rural markets are expected to have a significant impact for highly perishable food commodities such as dairy, seafood, fruits, and vegetables.	Cold Hub (This intervention can be combined with WP2)
Improved coordination in the supply chain through an SME	The fragmented production system in many SSA countries is an inherent constraint to an effective supply chain in the agri-food value chains. Many smallholder farmers and traders operate on individualistic basis making it difficult to provide them with efficient logistic services at a reasonable cost. Improving the logistic services may simply stem from a better coordination of operations in the supply chain in the agricultural sector. But innovative and effective models of organizing farmers are much needed. Existing traditional models of cooperatives have not generated the desired impact (World Bank, 2020). An SME can solve the coordination failure and play the role of interface by aggregating and coordinating the demand and use of the logistic services in the agri-food value chains.	Intriosynergy
Leveraging on technology to bring products to poor urban consumers	As many African countries experience a rapid expansion of their urban populations, neighborhood shops and vendors have become an important and growing retail food outlet. In many instances, the range of products available are limited and the prices are higher due to the high costs associated with product purchase and delivery. In response to this, a start-up, TradeDepot, has developed a successful business model to deliver products to the retail market in the urban communities. TradeDepot's innovative model addresses the inefficiency in the transport service and the coordination of product delivery to the retail market segment in urban cities. Like amazon prime, TradeDepot connects the retailers in urban neighborhood to a large suite of consumer products. Although the business model has expanded rapidly, it is currently limited to manufactured goods. This intervention could leverage TradeDepot's innovative business model to deliver food/agricultural products to retailers, i.e., adding new product lines to the goods delivered to the current customer base.	Trade Depot
Improved storage with hermetic storage bags (PICS bags)	Post-harvest losses continue to be a major constraint that prevents farmers and traders to engage in storage decision. Hermetic storage technologies can contribute to reducing quality (e.g., aflatoxin in maize) and quantity losses during storage and the excessive use of chemicals. Simple storage technologies such as PICS	Manufacturer (Lela Agro Industry) and Intri-oSynergy

	bags are effective for crops such as cowpea, maize, rice, soy-bean, common bean, sesame, groundnut (Baributsa and Cristine, 2020).	
Traceable transport services	The lack of an appropriate traceability system to monitor truck movements and more generally the coordination failure to identify available transportation services plagues the efficiency of the supply chain in the agricultural sector and also prevents farmers and traders from integrating structured market outlets. A start up provides a platform of transport services that can allow the market players in the agricultural chain to improve the ordering and the monitoring of transport operations.	Kobo360
Digital ICT applications to improve actor coordination and communication, as well as product traceability and chain transparency	One of the main challenges in these value chains is the lack of proper coordination, transparency and traceability of actors and products at each phase of the chain. Technology could also be deployed to facilitate shorter value chains whereby farmers easily have access to consumers and easy rural-urban linkage and traceability of operations.	Capture solution (This intervention can be combined with WP2)

5.2 Innovative DFS and potential partners

The following digital financial services (DFS) are proposed. Table 4 presents the descriptions and potential partners of these innovations.

1. Digital supply-Base intervention in addition to the delivery of an input loan bundled with agronomic and weather advisory. Digital supply-Base helps farmers to receive payments from off-takers in a timely and efficient manner by reducing large paper trails and harmonizing their data.
2. Digital delivery of input loans bundled with agronomic and weather advisory services.
3. An E-wallet card was also proposed as an intervention to be provided to farmers to drive ease of payment processing and financial inclusion.
4. Digital warehousing allowing farmers to move their farm produce to designated warehouses.
5. A centralized USSD that can give farmers access to information or a link to DFS providers in local languages.

Table 4. Innovations and potential partners for DFS in agri-food cross value chains services

Potential innovations	Justification and benefits	Potential partners
SupplyBase digital financial services. This automatically uses farmers' data (including micro-credit where available) together with their production data, matches it with their harvest and the agreed agro-processor's pricing, determines if they have met the quality and quantity standards and automatically generates payment vouchers.	<p>Despite the huge alternative markets that agro-processors can potentially offer smallholder farmers, fragmented and incomplete farmers' records, including their record of production and supply capacities, has posed grave limitations. Farmers' fragmented records are fraught with errors and inconsistencies. These slow payment processing and resolutions from Agro-processors, and consequently, smallholder farmers forced to receive payments by cash, leaving them further from the web of financial inclusion. Therefore, simplifying the management of small-holder farmers, increasing traceability and efficiency in managing smallholder operations and records can help to effectively process payments for smallholder farmers in a timely manner.</p> <p>Specifically, SupplyBase:</p> <ul style="list-style-type: none"> – Solve farmers' traceability and financial inclusion of underserved population by ensuring seamless payment processing for farmers by Agro-processor. - Create and bring better market opportunities for farmers and aggregators/processors using SupplyBase - Create opportunities for farmers to scale up production through digital financial solutions. 	Crop2cash, in partnership with First City Monument Bank
Digital delivery of input loans bundled with agronomic and weather advisory services	Lack access to improved modern inputs. Weather related advisory services can help farmers know when and how to make input use and key agronomic decisions. Digital input loans can facilitate smallholders access to input credit.	Agrorite and banks
An e-wallet card – This is not an ATM bank card, but an e-wallet card that farmers can use for payments and savings through the designated rural agents. This card enhances farmers access to financial services – farmers can make payments and deposit their savings using the e-wallet	<p>Through the Growth Enhancement Support (GES) program, in 2012 the Federal Ministry of Agricultural and Rural Development (FMARD) introduced a mobile wallet system to deliver government subsidized farm inputs (fertilizer and seeds) directly to farmers via GSM phones. This resulted in significant improvement in the efficiency of inputs distribution and helped up to twice as many farmers, reduced corruption, and at a sixth of the cost as compared to the earlier scheme where the government was involved in the direct procurement and distribution of fertilizer.</p> <p>Despite such significant efficiency gain, increased outreach, and cost-efficiency; the e-wallet system has not been practiced by private sector operators. Thus, intervention will test the functionality and update of the modified GES version of digital financial system (e-wallet card) with private sector operators.</p>	Crop2 Cash and Sterling Bank
Warehouse receipt to access finance ⁴	<p>To de-risk agriculture finance, and improve welfare of smallholder farmers, agricultural commodity warehouse receipting can be bundled with digital finance. By implication, data can be leveraged on, in such a way that farmers earn return for their production while still using the same commodity to bridge the collateral gap and encourage lending by digital credit providers.</p> <p>Warehouse receipt financing is the use of securely stored goods as loan collateral. These services allow producers to</p>	AFEX, Kitovu Technologies, Awesome fresh

⁴ This intervention is yet to be developed and discussion with potential partners is at its preliminary stage.

	deposit a finished good or agricultural product in a secure warehouse where the producer receives a receipt certifying the deposit of goods of a particular quantity, quality, and grade. The farmer can use the receipt as a form of portable collateral to request a loan from a financial institution such as a bank or an MFIs.	
A centralized USSD that can give farmers access to information or link to Digital financial service providers in local languages	<p>One of the major challenges in use of DFS is wide literacy gaps, lack of awareness or information on DFS. Developing a centralized USSD where value chain actors, particularly farmers can access information or link to various, major or verified DFS providers can spur effective adoption and use of DFS and help value chain actors access financial services. To bridge poor adoption that characterizes technology adoption in agri-food value chains, the content and information in the USSD can potentially be in local languages and simply delivered without any ambiguity.</p> <p>USSD (Unstructured Supplementary Service Data) is a Global System for Mobile Communications (GSM) that is used to send text messages. Like Short Message Service (SMS), it uses codes made up of characters that are available on a mobile phone, and uses codes made up of characters to create a real-time connection and enables two-way communication of information</p>	Crop2Cash and Sterling Bank

6. CONCLUSION

This scoping report explores existing activities related to cross-value chain logistics and financial service provision in Nigeria's agri-food systems. Information for this report was gathered largely through a review of the literature, field visits and stakeholder interviews. The report documents an emerging and growing dynamism in logistics and financial services in Nigeria's agri-food system, despite numerous challenges. While there is a rapid expansion of logistics service providers to meet the rapidly expanding need for transportation, storage and coordination of value chain actors, the logistics provision within the agri-food space is more developed for non-perishable food products than perishable commodities. Thus, the needs for innovation in logistics provision seems very apparent in the perishable food subsector. Some key findings emerging from the scoping report in the areas of agri-food logistics services include:

(1) Transportation remains a key constraint to the effective operation of agri-food supply chains in Nigeria. This constraint is consistently highlighted by value chain actors of all sizes and across all nodes of the agri-food supply chain (e.g., production, processing, and distribution). While transportation of food, generally, is a major constraint, this challenge is particularly faced by the value chains for perishable products such as fruit and vegetables. The majority of logistics innovations (e.g., coordination and backhauling) appear to dominate in the non-perishable consumer good sectors (e.g., final processed goods and grains).

(2) The majority of firms interviewed were either directly engaged in logistics service provision (even if logistics provision was not their primary business enterprise) or rented in logistics services for their clients (often at a cost). Renting in was very common among small and medium scale enterprises who are not able to afford in-house provision of the logistical services. There appears to be a huge need for innovations in this space to better serve all actors along food supply chains.

(3) There is a growing number of efforts to improve the ecosystem for value chain activities from production to distribution including the use of digital platforms and strategies to effectively link value chain actors through one-stop-shop models.

(4) The majority of the enterprises interviewed were interested in continuing conversations with the study team and potentially collaborating. Finally, security remains a key challenge noted by the majority of those interviewed. Adjusted practices (such as travelling during daylight versus overnight) seem to dominate with limited use of insurance due to high costs and insufficient insurance products available which could be something to explore further.

Based on these findings, the following points summarize key features of (digital) financial services in Nigeria's agri-food sector.

(1) There exists wide demand-supply gaps (about 90 percent financing gap for agricultural finance) in (digital) financial services (DFS) in agri-food sector in Nigeria. Weaknesses of the agricultural sector, lack of collaterals, uncertainty, and risk inherent in agriculture, high transaction costs, and knowledge gaps are the key factors that explain the large financing gap in the sector. For instance, the agricultural sector accounts only 5 percent of the total loans from commercial banks. Data from the central bank of Nigeria (CBN) show that the agricultural sector received the least credit from commercial banks as compared to other sectors.

(2) Informal financial markets such as friends, relatives, neighborhood money lenders, local rotating saving, and loan associations, and cooperatives dominate agricultural financing among smallholders and SME agri-businesses in Nigeria. Moreover, cash is still a key instrument in use by smallholder farmers despite several initiatives by social enterprises and groups to digitize payments along the agri-food value chain. Many smallholder farmers still buy agricultural inputs with cash and get paid with cash for their produce. For instance, an estimated 96 percent of Nigerian farmers pay cash for their inputs.

(3) However, there exists large untapped opportunities for the growth of DFS in Nigeria. The growing number of mobile phone users and penetration of broadband internet has spurred increasing adoption of digital financial services in Nigeria. The majority of the DFS innovation observed from our key informant interview (KII), relies on mobile phone access by actors and farmers. The use of mobile

apps to collect and process data has also become an efficient alternative to the laborious documentations required for various operations that has contributed to the percentage of those who are financially excluded.

- (4) There appears a growing network of agents in the agri-food value chain. This agent network can help in driving awareness and education of consumers. In the case of farmers in the rural economy, the agents drive adoption, train and helps farmers solve bottlenecks preventing them from using DFS. For example, the Cash2Crop (a digital-financial services provider that enables smallholder farmers in rural Nigeria to receive digital payments and build their financial identity) leverages its agent network across about 30 states of Nigeria to train smallholder farmers on the use of their mobile applications and USSD solutions. Similarly, some DFS providers use extension officers with experience working with smallholder farmers to drive adoption of DFS, which significantly mitigates some market barriers to entry often faced by agricultural tech-startups working within the agri-food value chain.
- (5) The scoping report finds that institutional barriers to entry, lack of trust, and low digital literacy among smallholders, cybercrimes and online frauds, and weak digital infrastructure could be the major constraints to the adoption and scaling up of innovations in digital financial services in Nigeria.

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ANNEXES

Annex 1. Characterization of agri-food logistics services providers/stakeholders consulted or interviewed

Table A1.1. Upstream: on-farm logistics

Name of the company	TOHFAN (Tractors Owners and Hiring Facilities Association of Nigeria) and Hepzibah Extra and Broadrivers Limited
Activities and value proposition	The company and the association provide tractor services to farmers. Hepzibath is also involved clearing services. The company operates mainly in the South. The company indicates that the demand for tractor service is large and growing. The cost of tractor service varies depending on the location and the distance of farms
Problems/Challenges	- Providing services to fragmented farms remains one of the main challenges -Access to loan to expand capacity (tractors) to meet the increasing demand
Potential innovations	-One shop stops of agricultural mechanization service (plowing, clearing, etc.) -organizing farmers in groups or clusters to facilitate service ordering
Contact	Paul Hepzibah Chairman of TOHFAN CEO of Hepzibath 0806 728 3770

Name of the company	Hello Tractor (further talks were expected with the company)
Activities and value proposition	The company provides tractor services to farm and has operations across the country. Through a tractor sharing application, Hello Tractor aims to connect tractor owners and smallholder farmers in need of tractors
Problems/Challenges	The challenge lays also in the fragmented demand that prevents to expand the service.
Potential innovations	
Contact	Ambima Munza +234 706 844 5594

Table A1.2 Midstream and downstream: Storage service and equipment

Name of the company	AFEX
Activities and value proposition	AFEX owns storage facilities in rural communities and local government areas. Community storage facilities are usually around 200 MT. AFEX provides full advisory services to farmers who are members of its network. AFEX also rents out his storage facilities (about 500 Naira/MT/Month) to farmers who want to store their products to sell later in the season. AFEX works usually with third party logistics for transport operations.
Problems/Challenges	One of the main logistic challenges is truck tracking and missing data information about the truck movement (returning trucks, confirmation of delivery, traceability)
Potential innovations	AFEX has developed an in-house logistics application that facilitates the truck tracking.
Economic implication	AFEX believes that this application to track truck movement could have reduced the cost by about 30 percent
Contact	Hemense Okar VP Corporate services 0901 492 6775 horkar@afexnigeria.com

Name of the company	CelPlast Industries
Activities and value proposition	The company manufactures plastic crates. The company is based in Ogun state and has representatives in several states.
Problems/Challenges	<p>The company does not indicate any major challenges since the demand for plastic crates is high. Products can be customized. The company sells the 20 Kg plastic crate for 4,000 Naira and considers the price to be competitive. The company claims to have a good quality product compared to its competitors.</p> <p>The cost of the plastic remains expensive for smallholder farmers.</p>
Potential innovations	The company may provide customized products depending on the size of the order (further talks are needed). An approach could be to aggregate the demand from farmers and/or traders to reduce cost.
MaContact	<p>Sindkar abhay sindkar.abhay@gmail.com Sailes +234 806 566 3223</p>

Table A1.3. Midstream and downstream: Transportation service

Name of the company	Kennie-O Cold Chain Logistics (KCCL)
Activities and value proposition	<p>-The company provides refrigerated transport and cold storage solutions to fresh agricultural products (fruit and vegetables) as well as the pharmaceutical industry. The company rent out trucks and help their customers to move their products from the farm gate to the final market.</p> <p>-The company generates further revenue through their cold room facility where customers can store their products. The company also buys produce directly from smallholder farmers and sell to end-users.</p> <p>-The company has partnerships with major markets, embassies, and retail stores – such as Shoprite and Spar. The company headquarter is in Ilorin, Kwara State.</p> <p>- The growing demand for temperature-controlled trucks suggest that this investment is profitable.</p>
Problems/Challenges	<p>-KCCL has identified that controlled temperature suitable to perishable agricultural products is sometime missing in the sector. In addition, refrigerated transport should be complemented with storage facilities at the delivery point.</p> <p>-Lack of loan to acquire appropriate trucks and expand his activity</p>
Potential innovations	Improved temperature-controlled system in trucks with tracking system
Contact	<p>Kennie-O Cold Chain Logistics (KCCL) Ope Olanrewaju CEO +234 803 406 6920</p>

Name of the company	Awesome Fresh
Activities and value proposition	<p>Awesome fresh is a SME which started as a farm business in fruit and vegetables 2 years ago, then moved into cold transportation service after observing the supply gap in this area. The company owns a 5 tons cooling van and plan to acquire a second one by the end of the year. The company partners with third party truck owners (6 formal partners). The company also aggregates products (tomato, pepper, broccoli, frozen foods -mostly chicken-, etc.) from farmers in six states.</p> <p>The main customers include farmers' association in the North (Vegetable Marketing Association), poultry farmers and processors, food service Operators (Chicken Republic, Food Concept).</p>

	<p>The current cost of service for a 5 tons truck is on average: Kano – Lagos 680,000 Naira (22-28 hours), Ibadan-Lagos 150,000 Naira, Abeokuta-Lagos 80,000 Naira, Abuja-Lagos: 400,000 – 480,000 Naira.</p> <p>The company considers that there is huge supply gap in the market and is therefore willing to collaborate and partner with other logistics companies, logistics software companies, and research centers.</p>
Problems/Challenges	<ul style="list-style-type: none"> - Limited capacity to meet the demand - Informal process and lack of traceability - Taxes and over regulations (changing rules from Local Government Area to LGA)
Potential innovations	<ul style="list-style-type: none"> - Expand fleet capacity with partners - Mobile app to help the customers to order trucks - Remote tracking of trucks (to monitor temperature, humidity, in real time, and send back information to customers)
Contact	<p>Mr. Adetiloye 0806 275 3737 adetiloye@awesomefresh.ng</p>

Name of the company	TradeDepot
Activities and value proposition	<p>TradeDepot's innovative model addresses the inefficiency in the transport service and the coordination of product delivery to the retail market segment. Like amazon prime, TradeDepot connects the retailers in urban neighborhood to a large suite of consumer products. In fact, TradeDepot enables factory-to-retail distribution for consumer goods companies such as Unilever, Danone, Unilever, Kellogg's, Indomie, Nasco, etc (https://www.tradedepot.co/). The company serves a network of about 100,000 retailers, more than 75 percent of whom are female entrepreneurs. TradeDepot's app platform gives these small retailers a real time view of all prices and discounts available from every major brand. They can order products directly, which are then delivered to them within 24 hours, with the order routed to the appropriate nearby depot. At the same time, manufacturers have full visibility over their distribution and can leverage the platform to optimize deliveries to their distributors, improve their pricing and have a direct channel towards their end-retailers. In addition, to help retailers grow their businesses, TradeDepot has developed micro-loans to enable them buy more products, backed by financial partners. TradeDepot is active across 10 cities in Nigeria (and 5 states), Ghana and South Africa (Accra, Johannesburg).</p>
Problems/Challenges	<p>Although the business model has expanded rapidly over the past 6 years, it is currently limited to manufactured goods.</p>
Potential innovations	<p>A potential intervention could be to leverage Tradedepot's innovative business model to deliver food/agricultural products to retailers, i.e., adding new product lines to the goods delivered to the current customer base.</p> <p>It is expected that this innovation could reduce the cost of food delivery and create another market outlet for SMEs that coordinate upstream agricultural and food supply. In this regard, the target commodities could be cereals which record the largest share of the food budget in urban areas in the North and the second largest share, after meat, in the South, according to 2018-2019 NBS data. The research will measure whether this business model could increase the demand and reduce the cost of delivering agricultural products to urban customers.</p>
Contact	<p>Martin Afegah Head Commercial Operations mafegbah@tradedepot.co +234 907 584 0873</p>

Name of the company	Lanrot Integrated Agricultural enterprises (Mr. Rotimi)
Activities and value proposition	The expert runs a large poultry farm. He owns trucks to deliver his products. He also rents out his trucks to other poultry farmers as an additional source of revenue.
Problems/Challenges	The company identifies the following key issues: <ul style="list-style-type: none"> - the rising cost of fuel - the insecurity situation that prevents trucks to travel during the night - High cost of insurance - Trucks used for birds transport cannot be used for other agricultural commodities because of sanitary issues.
Potential innovations	The use cargo on rails is also another potential transport means
Economic implication	The benefice cost analysis of this innovation has not been conducted
Contact	Mr. Rotimi

Table A1.4. Midstream and downstream: Platform and coordination services

Name of the company	Capture solution
Activities and value proposition	<p>Capture solution operates in several countries in Africa with headquarter in Kenya. The company operates in organized value chain crops such as cotton, cocoa, cashew, and tea (Kenya). The company does not work with individual customers but provides business to business services. Its customer base includes companies and organization such as Unilever, CBN (Central Bank of Nigeria), National Cotton Association, etc.</p> <p>The company provides digital solutions along the value chain. The service includes weighting farmers' produce, traceability system, farming management. These digital systems are important for buyers to track farmers' outputs and obtain the needed information on the quality and quantity of products.</p> <p>One key application is the weight capture where farmers can weigh their product using a weight scale and a software application.</p> <p>The hardware costs 600-800 USD, Software \$ 1,500 with about \$ 200-500 for each of the 3 modules Extension or support agents to train and implement the system can cost about \$ 100/Month. The overall system can cost up to \$ 2000-5000 per year depending on the type of software modules and the assistance provided by the company. That means the system can cost between \$ 20-50 per year for a group of 100 farmers.</p>
Problems/Challenges	So far, the company has been working with organized groups and businesses. The cost of the service remains high for individual and fragmented farms.
Potential innovations	The value proposition of the capture solutions could facilitate farmers' access to organized markets and large customers to sell their products, and to benefit from financing by providing reliable data to FIs (financial institutions). But the challenge remains the cost of the solutions which remains high for an individual farmer. But it is possible to develop a business model where farmers are organized into clusters/cooperatives to operationalize these solutions and provide new opportunities of markets and financial support.
Contact	ng@capturesolutions.com +234 817 977 5237

Name of the company	Farm 365
Activities and value proposition	<p>Farm 365 markets vegetable products. The company buys from farmers and sell to customers in urban areas. They do not deal with traditional food markets, but large customers and retail food operators such as Chicken Republic.</p> <p>The company used to have its own truck, but now partners with commercial companies. The experience with the commercial truck companies has not been conclusive. The system remains inefficient, with huge amount of waste, about 40 percent of loss. The strategy is now to harvest products fully unripe or half-ripe. The company has worked with ColdHub to rent in cold rooms. But Farm 365 reports that Cold Hub has maintenance issues with its facilities.</p> <p>The company works mainly in Kano and Kaduna in collaboration with farmer associations. Farm 365 also provides advisory services using “farmer ambassadors” as focal points to sensitize their peers about the platform of services. The company operates in the communities where they can at least obtain 20 farmers to work with.</p> <p>The company emphasizes the huge price differential between the sourcing and the delivery markets for vegetable products. For example, a tomato basket that costs 800 to 1000 Naira in Kano can amount to 20,000 Naira in Lagos. The company uses plastic crates as a storage transportation means. The plastic crate is purchased from Dangote in Kano, costing 1,500 to 2,500 Naira for a 20 kg format, and can last a year.</p> <p>There is no benefit cost analysis at this stage, but the high demand for adequate transport services could suggest that the economic benefit is positive.</p>
Problems/Challenges	<ul style="list-style-type: none"> -There is an insufficient number of trucks with adequate controlled temperature for fresh vegetable products. -There is coordination failure in the ordering of trucks, since most appropriate trucks are only available upon return, once they have delivered products in a location
Potential innovations	-Innovations may come from appropriate trucks that can accommodate fresh vegetables with controlled temperature.
Contact	<p>Abdulaziz Kabir 0303 440 6665 Abdulaziz.kabir@farm365.farm</p>

Name of the company	Intrio synergy
Activities and value proposition	<p>Intrio supports smallholder farmers to effectively adopt productivity enhancing technologies leading to improved yields and enabling them to participate in agriculture value chains through its market driven solutions and services. Specific areas of support include farmer aggregation and out-grower programs. The company offers a range of services which helps smallholders integrate into the value chain of agro-allied industry players, enabling them access critical inputs and services thereby obtaining improved yields, earn better income sustainably.</p> <p>Intrio works with about 40 000 Farmers in 11 states. The company implements a flagship project in the North-East on Youth Agripreneur Leadership. The project aims to support 8500 young farmers of whom 45 percent are women. The target crops are rice, maize, groundnut, soyabean. The company is also working on an initiative where youth</p>

	begin in the primary production and then graduate into input and processing activities so that they could secure revenues from different nodes of the market.
Problems/Challenges	A key challenge in many value chains in Nigeria is market access. Smallholder farmers without guaranteed access to markets are less able to adopt productivity enhancing technologies and agro-processing firms are unable to access sufficient high-quality inputs in sufficient quantities.
Potential innovations	Platforms that provide coordination services can also reduce the logistics constraint and improve value chain operations.
Economic implication	Such a platform could contribute to reduce the production and logistics cost, while increasing the market opportunities for smallholder farmers.
Contact	Dr. Innocent Okuku 08162797325 drokuku@gmail.com

Name of the company	Aquatic hub
Activities and value proposition	Aquatic Hub teaches skills that would in turn encourage farmers to utilize Good Aquaculture Practices (GAPs) in bridging the gaps in the African aquaculture space. The company also produces and sells fingerlings. They collaborate with large scale and small farmers.
Problems/Challenges	-Aquatic hub identifies the appropriate storage of fish during transportation as one the main challenge. The lack of appropriate storage during transport entails important losses and prevent small fish farmers to integrate organized markets. -When farmers cannot access markets, having refrigerated storage equipment can also help them conserve their products. But this simple technology is missing on many fish farms.
Potential innovations	- Develop specialized transport systems for fish - small scale mobile freezers (solar-powered) are being explored as an alternative to provide easy access to refrigeration to farmers. The prototype is still not completed.
Economic implication	The benefit will be PHL reduction; but the benefice cost analysis of these potential innovations has not been conducted.
Contact	Steve Okeleji CEO 0703 424 8150 steve@aquatichubafrique.com

Annex 2. Characterization of selected digital financial services providers consulted/in- interviewed

Name of DFS provider	Crop2Cash (www.crop2cash.com.ng)
Product	<ul style="list-style-type: none"> - Mobile Application - USSD
Value proposition	Cash2crop is an indigenous digital-financial services provider that enables smallholder farmers in rural Nigeria receive digital payments and build their financial identity.
Key Solutions	<p>Digital financial processing and payments</p> <ul style="list-style-type: none"> o Crop2cash through its simple and easy to use USSD and Mobile apps enables farmers to open Cash2crop bank accounts, process payments and makes transactions. <p>Input Purchase (Both credit and Cash purchase)</p> <ul style="list-style-type: none"> o Farmers can use their Cash2crop Mobile apps and USSD to purchase inputs such as fertilizer and improved seeds either on credit or direct purchase.
Key Metrics	<ul style="list-style-type: none"> - The organization as at the end of 2021 has worked with over 11,000 farmers across Nigeria - Worked with about 4300 women smallholder farmers (representing 39 percent of total farmers) as of 2021. - Over 100 network agents spread across 30 states of Nigeria, supporting adoption and use of DFS
Challenges	<ul style="list-style-type: none"> - Wide literacy gaps - Relatively low level of trust in digital technologies

Name of DFS provider	Agrorite (www.agrorite.com)
Product	<ul style="list-style-type: none"> - Web-based Platform - Customized E-wallet
Value proposition	Agrorite is a technology driven platform that enables small holder farmers with finance, advisory services and premium markets. Agrorite provides smallholder farmers with finance, inputs, and profitable markets linkages.
Key Solutions	<p>Digital finance</p> <ul style="list-style-type: none"> o Farmers can access credits and other financial services through customized wallets and hence ensures financial inclusion. <p>Input Support</p> <ul style="list-style-type: none"> - Through Agrorite, farmers can access farm inputs on credit and then pay back in kind (farm produce. Agrorite uses technology to make inputs and funds accessible to farmers. Profits from farmers proceeds are shared towards loan repayment, with the larger part of the proceeds goes to the farmers.
Key Metrics	<ul style="list-style-type: none"> - Over 150,000 farmers' network - 38 percent female farmers - Operations in 25 states of Nigeria
Challenges	<ul style="list-style-type: none"> - Wide literacy gaps - Relatively low level of trust in digital technologies - Strong barrier to entry

Name of DFS provider	Agromall (www.theagromall.com)
Product	Mobile App, USSD
Value proposition	Agromall is a digital platform that uses technology and data to enhance production and market participation in agriculture. AgroMall works with smallholder farmers and agribusinesses to access varieties of affordable financial services that will help them to improve their practices and expand their production.
Key Solutions	<p>Digital payment support An account management system that makes it possible for clients to automatically make fast and convenient payments to farmers and other users, thereby improving efficiency and correctness of payments. Leveraging its ubiquitous network of agents, helps farmers to access and manage cash and help other users reach deep into agrarian communities for payments.</p> <p>Digital Banking Support Agency banking that helps smallholder farmers to easily interact with financial services providers to enjoy numerous financial services such as cash management, funds transfer, credit and payments</p>
Key Metrics	<ul style="list-style-type: none"> - 15 crops - 39 farmers association
Challenges	<ul style="list-style-type: none"> - Wide literacy gaps - Relatively low level of trust in digital technologies - Poor rate of digital technology adoption

Name of DFS provider	Thriveagric (www.thriveagric.com)
Product	Mobile App, USSD
Value proposition	Thriveagric is a fast-growing agricultural technology company that is passionate about ensuring food security. The Organization link farmers to capital, data-driven best practices and access to local and global markets
Key Solutions	<p>Digital finance</p> <ul style="list-style-type: none"> - Thriveagric facilitates finance to farmers digitally through farm inputs and not cash. The Organization leverage farm mapping data and digital tools to calculate and disburse loans to smallholder farmers in form of improved seeds, fertilizers and crop protection products
Key Metrics	<ul style="list-style-type: none"> - More than 2600 communities of farmers reached - More than 250,000 farmers onboarded
Challenges	<ul style="list-style-type: none"> - Wide literacy gaps - Relatively low level of trust in digital technologies - Poor rate of digital technology adoption - Limited access to broadband internet across rural economy

Name of DFS provider	Pula insurance (https://www.pula-advisors.com/)
Product	Insurance Product Data and Digital product
Value proposition	Pula is an agricultural insurance and technology company that designs and delivers innovative agricultural insurance and digital products to help smallholder farmers endure yield risks, improve their farming practices, and bolster their incomes over time.

Key Solutions	<p>Digital Insurance service</p> <ul style="list-style-type: none"> - Crop2cash through its simple and easy to use USSD and Mobile apps enables farmers to open Cash2crop bank accounts, process payments and makes transactions. - Area Yield insurance: Protection against crop failure loss by triggering prompt pay-outs at end of season. The insurance cover can also be bundled with inputs demanded by farmers. Agronomic tips also sent to mobile phones to help farmers improve their farming - Loan/Input credit insurance: Facilitate distribution of insurance to lists of farmers as provided by Government/NGO/Credit Provider or any other partner - Index-weather based insurance: Insurance cover for germination failure, as a result of drought and flood <p>Data and Digital Products</p> <ul style="list-style-type: none"> - Develop digital products like digital agronomy via SMS and WhatsApp to help farmers improve productivity. - Leverage data to give partners insights on how to engage and serve farmers better. - Develop FieldSense Advise For farmer engagement, registration and education and Monitor For partners to track farmers performance, crop yields, climate, pest and disease challenges throughout the season. - Develop USSD to deliver information to farmers in a way to understand insurance as well as for farmers to make Pula/the insurer aware of incidence of loss.
Key Metrics and mile-stones	<ul style="list-style-type: none"> - 543,000 farmers loans with Central Bank insured - 511,437 Ha's across 37 states of Nigeria insured - 18,000 CCE's in 5 months cotton, rice, cassava, maize
Challenges	<ul style="list-style-type: none"> - Limited interest in purchasing insurance by farmers, despite their needs for them. - High basis risk for weather-index insurance, causing reputational risk limiting growth. - Limited experience with agric insurance by Development actors, who as a result don't include it in their program designs - Lack of efficient government policies as a result of limited experience with agric insurance

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