



USAID/Mozambique

Digital Agriculture Ecosystem Assessment

November 2023

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EXECUTIVE SUMMARY

In early 2023, DAI Global LLC contracted Athena Infonomics to conduct a Digital Agriculture Ecosystem Assessment in Mozambique. The goals of the assessment were: (1) Map existing and planned digital and ICT solutions being implemented in Mozambique; (2) Identify key opportunities for USAID investment; and (3) Provide targeted recommendations for tools and technologies to enhance the current and planned USAID agriculture activities. The intended users are USAID/Mozambique and implementers of its three major agriculture-focused projects: SPEED, PREMIER, and RESINA.

Between April and August 2023, a hybrid in-person and remote local and international team led by Athena Infonomics carried out a mixed methods assessment. Methods included a comprehensive document review and key informant interviews. In total, the team reviewed 30 documents and several dozen websites, and conducted 41 key informant interviews with a range of stakeholders from the Government of Mozambique, USAID projects, financial institutions, donors, farmer groups, and private companies and NGOs. The team used trend and content analysis methods to analyze the data collected. Limitations included old and outdated information on and difficulty establishing the status of digital solutions (for secondary document and website reviews), as well as sampling bias, or information limited to the knowledge of the stakeholders sampled.

Findings

Agriculture sector: Agriculture is a major contributor to GDP, making up more than a quarter of Mozambique's economic output and employing more than two-thirds of the country (nearly 6 in 10 farmers are women). Farming in Mozambique is overwhelmingly small-scale, with 4.2 million of 4.5 million farmers classified as smallholder. Use of improved agriculture is very low among Mozambican farmers and farmers generally lack access to sources of information on agriculture. In general, the country's agricultural production focuses on cereals, tubers, corn, and rice, with a niche production of cashew, with smaller fruit, livestock, and fishery production industries. The country has a substantial negative food import-export imbalance made worse by increasing inflation in recent years. The country is experiencing negative effects of climate change, intensified by deforestation and overfishing.

Digital ecosystem: With respect to infrastructure and connectivity, telecommunications infrastructure indicators in Mozambique are low compared to sub-Saharan Africa averages and near the bottom globally. About half of the population owns a cell phone, with lack of electricity cited as a major factor in not owning one. About one in five Mozambicans uses the Internet, accessed almost universally via mobile broadband. Internet speeds are fast in Mozambique relative to Sub-Saharan Africa and have increased substantially in recent years; however, mobile handsets and data packages are relatively unaffordable in the country. There is a large gender and rural-urban gap with respect to use of ICTs in Mozambique in favor of men and urban residents. On the digital governance side, Mozambique's ICT governance measures are consistently ranked near the bottom globally. The regulatory environment for ICT has slowly improved in recent years, however a glut of public agencies and regulators overseeing the ICT sector leads to confusion as to whom to approach for ICT-related efforts. Interoperability of telecommunications operators and infrastructure is enshrined in law but not carried out in practice leading to inefficiencies, quality issues, and reduced coverage. Mozambique has a host of e-governance service delivery platforms, but the systems are generally uncoordinated and not interoperable. Recent efforts to digitize mobile SIM registration to reduce fraud and cybercrime may act as a barrier to increasing uptake of digital services. While there is substantial legislation with respect to digital consumer protection, there is no evidence to show that the legislation is enforced. In the area of digital economy, access to and use of digital finance is varied in Mozambique, and highly inequitable between men and women. Though Mozambican policy generally supports the growth of digital financial services, smallholder farmers (SHFs) access finance (digital or otherwise) at very low rates. Digital literacy remains very low in the country, stifled primarily by lackluster education indicators.

Digital Agriculture, Demand-Side Considerations: For the most part, farmers lack basic information on agriculture and are generally lacking knowledge and skeptical of ICT solutions. Farmers receive information mostly

from radio and (infrequent) extension services. Low literacy, low financial literacy, and low digital literacy are the most common barriers to uptake of digital agriculture and digital financial services among SHFs. Farmers that use mobile money report important benefits from its use including security of cash, access to credit, and reduced travel time. There are substantial barriers and risks for the private sector to make money in the digital agriculture space including high transaction costs and low return on investment. Cost is a barrier to uptake and scale of digital solutions for both producers and investors. Savings groups are extremely popular in Mozambique, they offer access to finance for SHFs, and have acted as an avenue for introducing digital and digital finance solutions in the past. Requirements for opening mobile and bank accounts are overly burdensome for farmers and they are generally unbanked. Infrastructure-related issues of insufficient coverage, low quality, and low or no access to electricity hamper access to and use of digital services for access to finance solutions. Cybersecurity is a real threat in Mozambique, yet few practical actions have been taken to address it.

Digital Agriculture, Supply Side Services: The assessment team found evidence of at least 67 digital agriculture solutions focused on a variety of services from market and advisory information and supply chain logistics to financial and digital literacy. Solutions were for the most part based on smartphone and computer applications as opposed to SMS, USSD, or IVR. The creation, rollout, and use of applications, products, and services nearly universally followed disconnected donor funding cycles. The scale of solutions varied widely and was relatively small, reaching an average of 3,000 or fewer stakeholders each. A full list of solutions is presented in the Digital Agriculture section of this report.

Digital Finance for Agriculture: The assessment team found 28 separate digital agriculture financial services or interventions taking place in Mozambique, offered by a variety of public, private, and donor sources. The enabling environment for digital finance is generally burdensome and weak with stringent requirements from the Central Bank to open a financial institution, outdated financial regulations, and a high prime lending rate. Mobile money is rapidly expanding in Mozambique in the agriculture sector, but major constraints remain to scaling it up into rural areas, most notably insufficient coverage by mobile money agents. Interoperability of mobile wallets and banks exists in law but does not take place in practice. Banks perceive the agriculture sector as high risk and the small amount they invest typically goes to very large operations only. Stakeholders up and down the agriculture value chain participate in digital finance in very different ways, with few financial actors lending across value chain components. There are a few local actors large enough to make a systemic impact on access to finance in the agriculture sector including large banks, GAPI, and MADER. Women have been largely excluded from the digital financial system, yet they can and are benefiting from greater access to mobile money. Projects targeting access to finance for youth face large behavior change barriers. A full list of digital finance in agriculture services is presented in the Digital Agriculture section of this report.

Conclusions

Solving the root problems related to demand comes first. Digitization in Mozambique is still in the very early stages of development. To achieve truly successful and sustainable digital solutions, interested stakeholders must first address several key root problems limiting demand for digital solutions. First is expanded communication infrastructure, followed by improving the quality of telecommunications networks. Along with access and quality, cost is a critical challenge for uptake of digital services. The fourth key root cause of weak digitization prospects in Mozambique to be addressed centers on digital literacy.

It is imperative to match the solution to the context. Digital programming in Mozambique rarely matches the context in which it is implemented and is frequently disconnected from demand-side realities. Given the underdeveloped state of agriculture in Mozambique, digital agriculture programming must focus first on basic knowledge and inputs and utilize basic technology. Improving the services of extensionists-- which are at the same time trusted sources of information and sorely undertrained-- can be achieved through digital solutions.

Digital can facilitate access to finance in the agriculture value chain. When it comes to access to finance for the agriculture sector, mobile money has important implications for farmers but must overcome the issue of

lack of mobile agents covering rural areas. Savings groups provide an excellent venue to test out digital and mobile money interventions with the potential for scale. Banks require more and better information as well as mechanisms to reduce risk before they will invest in smaller actors in the agriculture value chain. E-vouchers present an interesting opportunity to solve several problems around access to finance up and down the agriculture value chain in one packaged intervention.

Sustainability is key. Essential to any intervention will be a realistic exit strategy to break the pattern of unsustainable donor cycle funded projects. Tapping into pre-existing active policy-level fora could help to strengthen sustainable efforts at the policy level.

Recommendations

More detailed information on recommendations including actors to work with and to whom the recommendations are targeted can be found in the Recommendations section of this document. High level recommendations aimed at the three USAID-funded projects include:

Area	Recommendation
Policy	<ul style="list-style-type: none"> ❖ Work with INTIC, INCM, INAGE and other digital-related agencies and regulators to advance several policy-level agendas - and reform existing regulations - affecting digitization. ❖ Work closely with GIZ at the policy roundtable level through active participation in the CIFAM dialogue mechanism, particularly Working Group 3 on Digitization in Agriculture. ❖ Work with GIZ and the Bank of Mozambique (BOM) to advance the goals of the Financial Inclusion Policy while it is still in its strategy phase.
Access to Finance	<ul style="list-style-type: none"> ❖ Work with SIMO, BOM, and GIZ to help finalize the design for a digital financial product that integrates savings groups into the formal financial system. Involve Hollard (for insurance) and IDEPA and Ophavela to socialize to and integrate savings groups. ❖ Focus on strengthening linkages between producers and agrodealers through piloting a new, or supporting the existing, e-voucher program. Involve FAO for best practices and SUSTENTA to scale coverage and limit redundancies. ❖ Continue to involve and work closely with GAPI on supporting key rural investments in agriculture to promote sustainability, legitimacy, and for local guidance.
Information and market linkages	<ul style="list-style-type: none"> ❖ Stimulate demand for digital services and increase digital literacy by helping rural schools, community centers, agrarian institutes, and TVET institutions connect to the Internet and providing them with digital content. Utilize community radio as a means to spread additional information about digital services. Partner with Starlink, CIEUM, and several other NGOs and CBOs (mentioned in this report) working on training and digital content provision. ❖ Support a relatively low-tech education module solution for extension worker training and refresher courses. Build off of previous and existing models such as Machamba app and involve MADER for sustainability. ❖ Work closely with MADER and FAO to rigorously assess the potential of SIMA to carry out its mandate of dissemination of accurate market information data. Involve Viamo and Nitadae to understand best practices in information dissemination. Ensure that training focuses on topics such as use of seeds and fertilizer, planting times, and pest and weather information.

INTRODUCTION

Background

The USAID-funded Digital Frontiers project is a \$90 million buy-in mechanism available to USAID Bureaus and Missions around the world from 2017-2024. DAI Global LLC, implements the Digital Frontiers project, which works closely with USAID's Technology Division in the Innovation, Technology, and Research Hub (ITR/T) at the Development, Democracy, and Innovation (DDI) Bureau, USAID Missions, the private sector, and international and local development organizations to identify successful and sustainable digital development approaches and scale their impact globally.

As of August 2023, the USAID Bureau for Resilience and Food Security (RFS) has supported 14 USAID Missions to conduct Digital Agriculture Ecosystem Assessments. USAID/Mozambique is in the early stages of startup on three major activities located in the Resilience Focus Zone (RFZ) of Zambezia and Nampula. Many of these activities plan to incorporate ICT and digital solutions to address key challenges in the agriculture sector.

With this in mind, in early 2023, DAI through the Digital Frontiers project contracted Athena Infonomics to conduct a Digital Agriculture Ecosystem Assessment in Mozambique. The study was a top priority for the Mission and represented an ideal opportunity to facilitate better coordination and harmonization of approaches between activities, increase efficiency and impact through the use of digital tools, and support a more inclusive digital economy. The assessment also builds off the momentum of the recent World Bank \$150 million grant to increase access to digital services under the Digital Governance and Economy Project (EDGE), enabling USAID to add value to the digital agriculture ecosystem. The goals of the assessment were:

1. Map existing and planned digital and ICT solutions being implemented in Mozambique;
2. Identify key opportunities for USAID investment; and
3. Provide targeted recommendations for tools and technologies to enhance the current and planned USAID agriculture activities.

Purpose

The purpose of this activity was to carry out a Digital Agriculture Ecosystem Assessments in support of the USAID/Mozambique Mission, with the goal of enabling them to better understand, work with, and support the country's digital agriculture ecosystem to meet development objectives. The assessment recommendations would be used to inform both current and future programming. Intended users are USAID/Mozambique and implementers of its three major activities - Supporting the Policy Environment for Economic Development (SPEED), Promoting Innovative and Resilient Agriculture Market Systems (PREMIER), and Resiliência Integrada na Nutrição e Agricultura (RESINA).

Key areas of interest for the Mozambique Mission included:

1. Digital Economy and Finance: Evaluate and identify opportunities to improve the enabling environment for digital finance in the agriculture sector as well as opportunities for digital finance. Understanding the current challenges around mobile money interoperability that limits digital transactions and what types of digital technologies and interventions would be feasible to increase access to financing for smallholder farmers (SHF) and increase agricultural productivity.
2. Market analysis of ICT and Digital Tools for Agriculture/Food Systems: Taking stock of what is currently being implemented in the area of ICT and digital-based solutions and understanding key areas for improved coordination, testing and scaling of key technologies.
3. Inclusivity in the digital economy: Job creation, digital literacy, and integration of women, youth, and marginalized groups into the digital economy.

METHODOLOGY

An assessment team consisting of one expatriate and two local Mozambican subject matter experts carried out data collection in-country and remotely between April and June 2023. The team subsequently analyzed, synthesized, and compiled data into this report in July and August. The assessment team utilized a mixed methods approach consisting of background document review, secondary data reviews, and primary data collection in the form of key informant interviews.

Document and secondary data reviews: The team reviewed dozens of documents including key USAID strategy documents (Mozambique CDCS, FTF Global Food Security Strategy GFSS Country Strategy), current USAID-funded project briefers (SPEED, RESINA, PREMIER, etc.), publicly available datasets from reputable multilateral agencies in the agriculture space (World Bank Database, UN, etc.) and international organizations in the digital space (GSMA, ITU, Datareportal, etc.), past studies, assessments, and evaluations of agriculture, digital, and finance projects in Mozambique from donors (USAID, GIZ, World Bank, others), and several other relevant documents. In total, the team reviewed over 30 standalone documents and several dozen websites. Sources are amply footnoted throughout the report.

Primary data collection: To supplement document review data, the team conducted 41 primary key informant interviews (KII) both in person in Mozambique and virtually. Individual respondents were associated with a variety of groups from the Government of Mozambique, financial institutions, and NGOs to USAID projects, bilateral donors, and community-based organizations. KII stakeholders were selected purposively based on their knowledge of the subject matter (digital, finance, agriculture and where those areas crossed) and/or involvement in USAID or other projects, past, and current, in Mozambique focusing in those subject matter areas. A summary of KII respondents is in Table I below.

Table I: KIIs conducted for the assessment

KII stakeholder category	Number of interviews conducted
Government of Mozambique (agencies, regulators, institutions)	14
USAID projects	4
Farmer cooperatives	5
Private financial institutions (banks, investment, insurance)	5
Donors (bilateral, multilateral)	7
Academic institute/NGO/CBO	2
Private companies, startups, telecommunications operators	4

Data Analysis: The team used a combination of content and trend analysis across interview transcripts and documents reviewed, grouping emerging themes by various subject matter areas of interest. The subject matter areas upon which this report is organized and structured include (1) the general Mozambican agriculture sector, (2) the digital ecosystem in Mozambique (organized by USAID’s Digital Framework principles of infrastructure and connectivity, digital governance, and digital economy), and (3) the confluence of digital services and agriculture in the country, inclusive of supply of and demand for services. Analysis was guided by an analytical framework looking at access to markets, services, and assets in the context of the digital ecosystem pillars explained above. The assessment team presented initial findings to USAID in a virtual stakeholder meeting in early June 2023, received feedback, and subsequently adapted our approach to reflect additional areas of interest from USAID.

Limitations and Gaps

The assessment had several limitations. While the assessment team reached close to the targeted number of key informant interviews (41/44), we were ultimately unable to secure interviews with a small set of critical stakeholders including one major mobile money operator and Starlink. The data collected in primary interviews

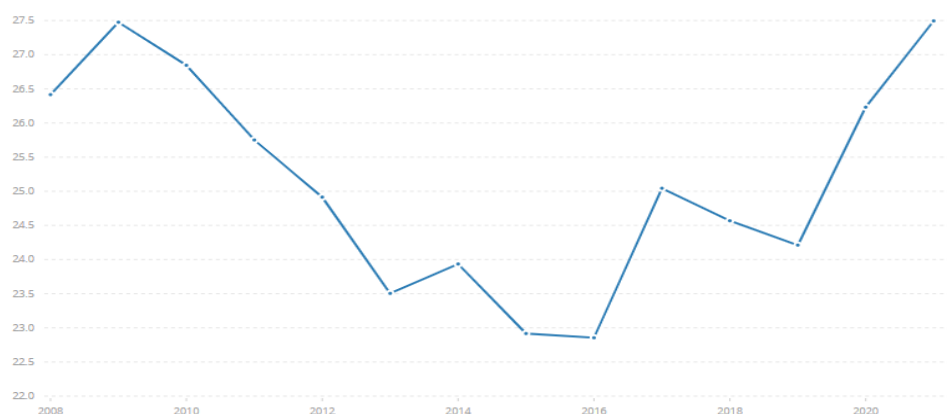
was limited to the quality and scope of knowledge that those stakeholders possessed, which in turn limited the information the assessment team was able to compile and synthesize. We mitigated these sampling risks by attempting to triangulate data across as many interviews and secondary data sources (e.g., document reviews) as possible and, where data was suspect, noted as such in the document. Data itself, particularly on agriculture, was at times difficult to verify given that it was typically at least three years old or conflicted between several sources. Digital-related data for Mozambique was more available and recent yet occasionally conflicted across sources. Digital solutions discovered by the assessment team were numerous in nature and the team did not have adequate time to track down and investigate each and every solution to verify their status. For these solutions, online information was usually limited to general website descriptions or project evaluation reports and typically several years out of date, casting doubt on the status of a digital solution as currently active in the country. At the same time, there was typically no or very little information on scale, scope, or contact details for most digital solutions found.

AGRICULTURE SECTOR

Mozambique ranks near the very bottom of Sub-Saharan Africa and globally in terms of development indicators. As of 2021, Mozambique ranked 185/191 in the UN's Human Development Index.¹ The Economist ranks the country 94/113 in its 2022 Global Food Security Index, with 38 percent of children experiencing stunting² and 40 percent of the population experiencing severe food insecurity.³ The adult literacy rate stands at 60.7 percent.⁴ In 2021, 62 percent of the population lived in rural areas, down from 68 percent a decade earlier.⁵

Agriculture is a major contributor to GDP, making up more than a quarter of Mozambique's economic output. According to USAID, 16 percent of arable land in Mozambique is currently farmed.⁶ Agricultural activity constituted 27.5 percent of GDP in 2021, equal to the share in 2009 and up from 22.9 percent in 2016. The share of agricultural production's contribution to GDP has increased, on average, about one percentage point per year since 2016 after falling by a slightly smaller margin between 2009 and 2016.⁷ At the same time, the percent of government spending on agriculture, forestry, and fishing declined significantly from 4.6 percent in 2010 to 1.2 percent in 2020.⁸ Figure 1 shows the change in the share of agriculture's contribution to GDP (y-axis) between 2008 and 2021.

Figure 1: Share of agriculture's contribution to GDP, 2008-2021



The total value added of agriculture, forestry, and fishing in Mozambique rose three percent per year from \$3.81 billion in 2016 to \$4.28 billion in 2020 (Figure 2), a plurality of which (35 percent) comes from roots and tubers

¹UNDP. 2023. *Human Development Insights*. Online at: <https://hdr.undp.org/data-center/country-insights#/ranks>

² Economist Impact. 2022. *Global Food Security Index 2022*. Online at: <https://impact.economist.com/sustainability/project/food-security-index/explore-countries/mozambique>

³ FAO. 2022. *World Food and Agriculture – Statistical Yearbook 2022*. Online at: <https://doi.org/10.4060/cc2211en>

⁴ The World Bank. 2023. *World Development Indicators*. Online at: <https://datatopics.worldbank.org/world-development-indicators/>

⁵ The World Bank. 2023. *Data*. Online at: <https://data.worldbank.org/indicator/SP.RUR.TOTL.ZS?locations=MZ>

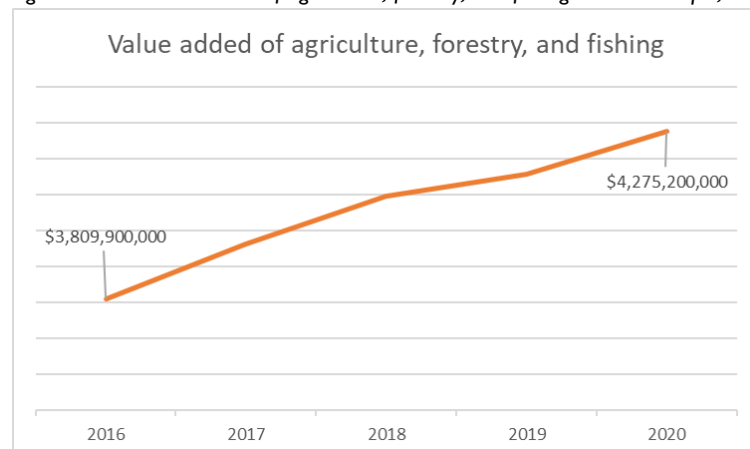
⁶ USAID. *Agriculture and Food Security*. Online at: <https://www.usaid.gov/mozambique/agriculture-and-food-security>

⁷The World Bank. 2023. *Data*. Online at: <https://data.worldbank.org/indicator/NV.AGR.TOTL.ZS?locations=MZ>

⁸ FAO. 2022. *World Food and Agriculture – Statistical Yearbook 2022*. Online at: <https://doi.org/10.4060/cc2211en>

such as cassava. With a coastline of 1,430 miles, Mozambique's fishery industry produced 403,000 tonnes in 2020, two-thirds of which were marine fish.⁹

Figure 2: Total value added of agriculture, forestry, and fishing in Mozambique, 2016-2020



Agriculture employs more than two-thirds of the country, nearly 6 in 10 of whom are women.

Agriculture employs 70 percent of the country's labor force, most of whom are subsistence farmers. Data from 2020 modeled by ILO suggests a wide discrepancy in gender participation with nearly 80 percent of women working in agriculture compared to 61 percent of men.¹⁰ Mozambique is one of only 20 countries worldwide where women outnumber men in the agricultural sector. As of 2022, the country had the third highest proportion of women to men in agriculture (58:42 percent), just ahead of Rwanda and Nepal.¹¹ Women typically carry out activities such as sowing, weeding, and planting while men generally participate in clearing the land and harvesting.¹² A 2016 study by João Morgado and Vincenzo Salvucci concluded that female-headed agricultural households in Mozambique were approximately 20 percent less productive than male-headed households.¹³ According to one stakeholder interviewed for this assessment: "The agriculture sector is dominated by women's labor in Mozambique; yet female farmers are considerably less productive, less likely to effectively engage in commercial agriculture, and are generally less able to reap the benefits from their work compared to men. Reasons for this are complex, but significantly linked to considerable physical and cultural mobility constraints faced by women."

Farming in Mozambique is overwhelmingly small-scale. Data collected in 2020 by the Mozambique Ministry of Agriculture's (MADER) annual Integrated Agrarian Survey estimates the number of smallholder farmers at just over 4.2 million, accounting for nearly 98 percent of all agricultural production. The report also notes that 35 percent of smallholder agricultural households are headed by women and approximately 80 percent own the land they work. Smallholder farmers have an average plot size of 1.4 hectares, with a total of 5.58 million hectares farmed across the country.

Use of improved agriculture is very low among Mozambican farmers. This includes the use of irrigation systems (9.1 percent of all smallholder farmers), chemical fertilizers (7.8 percent), pesticides (5.5 percent),

⁹ FAO. 2022. *World Food and Agriculture – Statistical Yearbook 2022*. Online at: <https://doi.org/10.4060/cc2211en>

¹⁰ The World Bank. 2023. *Data*. Online at: https://data.worldbank.org/indicator/SL.AGR.EMPL.FE.ZS?locations=MZ&name_desc=false

¹¹ FAO. 2022. *World Food and Agriculture – Statistical Yearbook 2022*. Online at: <https://doi.org/10.4060/cc2211en>

¹² FAO, European Union and CIRAD. 2022. *Food Systems Profile - Mozambique. Catalysing the sustainable and inclusive transformation of food systems*. Online at: <https://doi.org/10.4060/cc0498en>

¹³ Morgado, J. , Salvucci, V. (2016) Gender divide in agricultural productivity in Mozambique. WIDER Working Paper 2016/176. Helsinki: UNU-WIDER. <https://doi.org/10.35188/UNU-WIDER/2016/220-5>

herbicides (1.8 percent) and manure (8.8 percent).¹⁴ While use of chemical fertilizers remains low among farmers, the tonnage of applied nitrogen, phosphorus, and potassium increased nearly five-fold nationally between 2000 and 2020 and three-fold on a per hectare basis over the same period. Only 0.3 percent of farmed land benefits from irrigation.¹⁵

Farmers generally lack access to sources of information on agriculture. As of 2019, less than seven percent of smallholder farmers had accessed extension services and only 3.5 percent belonged to any type of association such as a cooperative from which they might glean information. Despite these low statistics, the 2019 agrarian survey found that in the past year, 40 percent of farmers indicated having received information on crop prices. Key indicators on smallholder farmers from the 2020 MADER report can be found in Table 2 below.

Table 2: Key indicators on access to information for SFHs

Indicators for smallholder farmers	Total
Accessed extension services	6.9%
Received information on crop prices	39.9%
Belong to an association (e.g., cooperative)	3.5%

Source: MADER Agrarian Survey 2020

Agriculture production focuses on cereals, tubers, corn, and rice, with a niche product of cashew. As of 2018, the top staple crops produced by Mozambican farmers included cassava, sugarcane, maize, sweet potato, banana, tomato, potato, coconut, onion, rice, and cashew nuts. Mozambique is the ninth largest producer in the world of cassava and eleventh largest producer of cashew nuts.¹⁶ Cereal production accounts for 40 percent of harvested area in the country.¹⁷ The top largest crops by production in Mozambique include cassava, sugar cane, corn, non-orange flesh sweet potato, banana, rice, and pigeon pea. By planting area (hectare), the top agricultural products are corn, cassava, beans, rice, sesame, pigeon pea, millet, and peanut.¹⁸ See Table 3 below for the top crops by production and harvested land area.

Table 3: Top crops produced and by harvested land area in Mozambique

Products with largest production	Production value (tons)	Products with largest harvested area	Area (ha.)
Cassava	6,025,663	Corn	2,286,362
Sugar cane	2,737,556	Cassava	556,093
Corn	1,632,321	Bean	348,274
Non-Orange Flesh Sweet Potato	303,246	Rice	290,417
Banana	258,599	Sesame	283,911
Rice	175,322	Pigeon pea	269,886
Pigeon Pea	160,000	Millet	262,579

Source: MADER Agrarian Survey 2020

¹⁴ Republic of Mozambique, Ministry of Agriculture and Rural Development. 2020. *INQUÉRITO INTEGRADO AGRÁRIO 2020*. Online at: https://www.agricultura.gov.mz/wp-content/uploads/2021/06/MADER_Inquerito_Agrario_2020.pdf

¹⁵ FAO. 2022. *World Food and Agriculture – Statistical Yearbook 2022*. Online at: <https://doi.org/10.4060/cc2211en>

¹⁶ FAO. 2023. *FAOSTAT*. Online at: <https://www.fao.org/faostat/en/#data/QCL>

¹⁷ FAO. 2022. *World Food and Agriculture – Statistical Yearbook 2022*. Online at: <https://doi.org/10.4060/cc2211en>

¹⁸ Republic of Mozambique, Ministry of Agriculture and Rural Development. 2020. *INQUÉRITO INTEGRADO AGRÁRIO 2020*. Online at: https://www.agricultura.gov.mz/wp-content/uploads/2021/06/MADER_Inquerito_Agrario_2020.pdf

Table 4: Key farm production indicators by top crops produced

Indicator	Corn	Rice	Sorghum	Millet
Percent of smallholder farmers producing	83.8%	12.8%	18.3%	3.6%
Use of certified seeds in planting	9.7%	4.9%	2.7%	--
Percent of smallholder farmers selling	20.2%	12.6%	6.7%	3.3%
Percent of smallholder farmers with post-harvest losses	13.5%	20.7%	19.7%	29.6%

Source: MADER Agrarian Survey 2020

Table 5: Key farm production indicators by top cash crops produced

Indicator	Corn	Rice	Sorghum	Millet
Percent of smallholder farmers producing	83.8%	12.8%	18.3%	3.6%
Use of certified seeds in planting	9.7%	4.9%	2.7%	--
Percent of smallholder farmers selling	20.2%	12.6%	6.7%	3.3%
Percent of smallholder farmers with post-harvest losses	13.5%	20.7%	19.7%	29.6%

Source: MADER Agrarian Survey 2020

Table 6: Cash Crops in Mozambique

Cash crop	Cotton	Tobacco	Sesame	Soy	Sunflower
Percent of smallholder farmers growing	1.7%	1.5%	14.0%	3.1%	0.7%
Area (ha.) cultivated (in thousands)	134, 900	73, 900	283, 900	65, 800	12, 300

Source: MADER Agrarian Survey 2020

The country has small but not insignificant fruit and livestock production industries. Mozambique produces and exports four principal fruits: banana, papaya, avocado, and lychee. Banana production in 2020 was 260,000 tons, papaya (6,300), avocado (2,800), and lychee (474). The proportion of this fruit production that is exported varies widely from a high of 83 percent (avocado) to 61 percent (lychee) and 11 percent (banana), with zero percent of locally produced papaya exported in 2020. In addition to fruit, large holder farm operations produce macadamia and cashew nuts. In 2020, macadamia production was 2.4 tons, of which 93 percent was exported. Cashew production, of which Mozambique is the eleventh largest producer in the world, saw 143,000 tons commercialized in 2020. All export is carried out by large holder farm operations. In addition to the fruit and nuts above, large holder farm operations produced 2.73 million tons of sugarcane in 2020 for local consumption.

Farmers in Mozambique raise livestock with a focus on bovine, small ruminants (goat and sheep), chicken, and pigs. MADER's 2020 report estimates a total of 1.6 million pigs, 2.1 million bovine-related livestock, 4.9 million small ruminants, and 20.8 million hens.¹⁹ Most livestock farmers (85 percent) are smallholder or "family farmers" who generally do not use improved methods such as vaccinations and enclosed pastures. Fifteen percent of livestock farmers constitute large-holder operations that are more market oriented and use improved inputs.²⁰

Mozambique has a substantial negative food import-export imbalance made worse by increasing inflation in recent years. In 2020, Mozambique's agricultural export value totaled \$557 million, with a plurality coming from exports of raw tobacco (29 percent), followed by various nuts including cashew (14 percent), and oil seeds and oleaginous fruits (13 percent). During the same period, the country imported \$1.204 billion worth of

¹⁹ Republic of Mozambique, Ministry of Agriculture and Rural Development. 2020. *INQUÉRITO INTEGRADO AGRÁRIO 2020*. Online at: https://www.agricultura.gov.mz/wp-content/uploads/2021/06/MADER_Inquerito_Agrario_2020.pdf

²⁰ FAO, European Union and CIRAD. 2022. *Food Systems Profile - Mozambique*. *Catalysing the sustainable and inclusive transformation of food systems*. Online at: <https://doi.org/10.4060/cc0498en>

food, the largest of which came from rice (21 percent) and wheat/meslin (18 percent), and palm oil (14 percent).²¹ This amounts to a net food trade value (exports minus imports) of negative \$647 million in 2020. Inflation in the food consumer price index rose steadily in Mozambique from zero percent in 2018 to 3.3, 7.6, and 10.9 percent in 2019, 2020, and 2021, respectively.²² The table below shows key data on agriculture value chain operations in Mozambique, using source data from between 2017 and 2021.²³

Table 7: Number of holdings and actors in food systems in Mozambique

Agricultural holdings	4.3 million (total)
Small agricultural holdings (family sector farmers)	4167702 (97.8%)
Medium agricultural holdings	93183 (2%)
Large agricultural holdings	873 (<1%)
Number of companies in agriculture, animal production, hunting and related service activities	471
Number of companies in forestry and related activities	80
Number of companies in fisheries and aquaculture	98
Number of food processing industries	1322
Number of beverage manufacturing industries	66
Number of water collection, treatment and distribution, sanitation, waste management and pollution-handling companies	213
Number of companies in catering and similar activities	3350
Cumulative number of Industrial fishing boats licensed from 2009 to 2017 - national fleet	730
Cumulative number of industrial fishing boats licensed from 2009 to 2017 - foreign fleet	563
Cumulative number of semi-industrial fishing boats licensed from 2009 to 2017	2899
Cumulative number of artisanal fishing gears (family sector fishers) licensed from 2009 to 2017 (including gears licensed in 2012)	177511
Sanitary licensing of production units (national)	2802
Number of partners of the Mozambican Cereals Institute that carry out agricultural marketing and agroprocessing	75
Number of locally produced milk processors/cooperatives in the center of the country	15/5
Storage and weighing units for cereals and beans in silos of the Mozambique Commodity Exchange: Lichinga in Niassa province, Nhamatanda and Gorongosa in Sofala; Nanjua in Cabo Delgado, Malema in Nampula, Mugema in Zambezia province and Ulongue in Tete	

Source: FAO Mozambique Food Systems Profile 2022

The country is experiencing effects of climate change in the form of major weather events, rising sea levels and drought, while contributing to climate change through deforestation and overfishing. In 2020, the Mozambican agricultural sector emitted 76 million tonnes of greenhouse gasses, 70 percent of which came from net forest conversion activities (deforestation).²⁴ The country is experiencing a rate of deforestation of approximately 0.79 percent per year since 2003, or a loss of nearly 270,000 ha. per year. Similarly, the fishing industry, which employs 60 percent of coastal populations, has seen a decrease of around 30 percent in average yields in the past 25 years, mostly due to overfishing and destructive illegal fishing practices.²⁵ According to an analysis by Montfort, et. al in 2020, in the last 20 years over a quarter of land in Mozambique has experienced substantial soil degradation due in

²¹ WTO. 2022. *World Trade Organization Mozambique Trade Profile 2022*. Online at: https://www.wto.org/english/res_e/statis_e/daily_update_e/trade_profiles/MZ_e.pdf

²² FAO. 2022. *World Food and Agriculture – Statistical Yearbook 2022*. Online at: <https://doi.org/10.4060/cc2211en>

²³ FAO, European Union and CIRAD. 2022. *Food Systems Profile - Mozambique. Catalysing the sustainable and inclusive transformation of food systems*. Online at: <https://doi.org/10.4060/cc0498en>

²⁴ FAO. 2022. *World Food and Agriculture – Statistical Yearbook 2022*. Online at: <https://doi.org/10.4060/cc2211en>

²⁵ FAO, European Union and CIRAD. 2022. *Food Systems Profile - Mozambique. Catalysing the sustainable and inclusive transformation of food systems*. Online at: <https://doi.org/10.4060/cc0498en>

part to monocropping of maize, rapid population growth, and deforestation. Climate change also contributes to this situation, particularly droughts, cyclones, and tropical storms.²⁶

²⁶ Montfort et al., (2020): Montfort, F., Bégué, A., Leroux, L., Blanc, L., Gond, V., Cambule, A.H., Remane, I.A.D., Grinand, C., 2020

DIGITAL ECOSYSTEM

Digital Infrastructure and Adoption

Telecommunications infrastructure indicators in Mozambique are low compared to sub-Saharan Africa averages and near the bottom globally. As of 2020, 30.6 percent of the population had access to electricity, however this figure is only 4.6 percent for those residing in rural areas.²⁷ GSMA data from 2021 indicates that 85 percent of the country is covered by 2G cellular service, 65 percent by 3G (SSA average of 83 percent), 43 percent by 4G (SSA average is 58 percent), and zero 5G coverage (on par with SSA).²⁸ Mozambique scores a 40.5 on GSMA's Infrastructure score for 2021, below the Sub-Saharan Africa average of 46.9.²⁹ According to the 2022 State of Mobile Connectivity Report, Mozambique ranks seventh-worst of all countries globally in terms of the Internet coverage gap--rates of population not covered by broadband (3G or better).³⁰ The World Economic Forum (WEF) Network Readiness Index, which benchmarks a country's willingness and ability to further ICT adoption, ranked Mozambique 125th out of 133 countries in 2022, including 109th place in terms of 3G coverage.³¹ Finally, the Africa Infrastructure Development Index (AIDI) gives Mozambique a score of 8.55 out of 100 in ICT infrastructure for 2022, ranked 44/54 in Africa.³² A 2019 World Bank review of digital agriculture found that infrastructure is weak in rural areas due to high deployment costs, low commercial returns, and reduced investments/expansion in infrastructure from mobile operators due to reduced income from an increasingly competitive enabling environment.³³

There are three major telecommunications companies in Mozambique with varying coverage in urban and rural areas. The three major telecommunications companies in Mozambique are Vodacom (owned by Vodafone group), Tmcel (owner: Telecomunicacoes De Mocambique SARL and Mcel), and Movitel (owner: Viettel). Currently, Vodacom has the largest market share (40 percent), followed by Movitel (35 percent), and TMcel (25 percent).³⁴ However, other estimates put Vodacom as high as 50 percent³⁵ and TMcel as low as 13 percent.³⁶ Vodacom offers substantial 4G access nationwide while the other two operators' 4G coverage is limited to mostly urban areas. Movitel, on the other hand, according to several interviews conducted for this

²⁷ The World Bank. 2023. *Data*. Online at: <https://data.worldbank.org/indicator/EG.ELC.ACCS.RU.ZS?locations=MZ>

²⁸ GSMA. 2023. *The State of Mobile Internet Connectivity 2023*. Online at: <https://www.gsma.com/r/somic/#regions>

²⁹ GSMA. 2021. *GSMA Mobile Connectivity Index*. Online at: <https://www.mobileconnectivityindex.com/connectivityIndex.html#year=2021&zonesocode=MOZ&analysisView=MOZ>

³⁰ GSMA. 2022. *The State of Mobile Internet Connectivity 2022*. Online at: <https://www.gsma.com/r/wp-content/uploads/2022/12/The-State-of-Mobile-Internet-Connectivity-Report-2022.pdf>

³¹ POTULANS Institute. 2022. *Network Readiness Index – Performance Overview*. Online at: <https://networkreadinessindex.org/country/mozambique/>

³² Africa Infrastructure Knowledge Program. *Africa Infrastructure Development Index (AIDI), 2022*. Online at: <https://infrastructureafrica.opendataforafrica.org/pbuerhd/africa-infrastructure-development-index-aidi-2022>

³³ The World Bank. 2019. *Mozambique Digital Economy Diagnostic Executive Summary Report*. Online at: <https://thedocs.worldbank.org/en/doc/833211594395622030-0090022020/original/MozambiqueDECA.pdf>

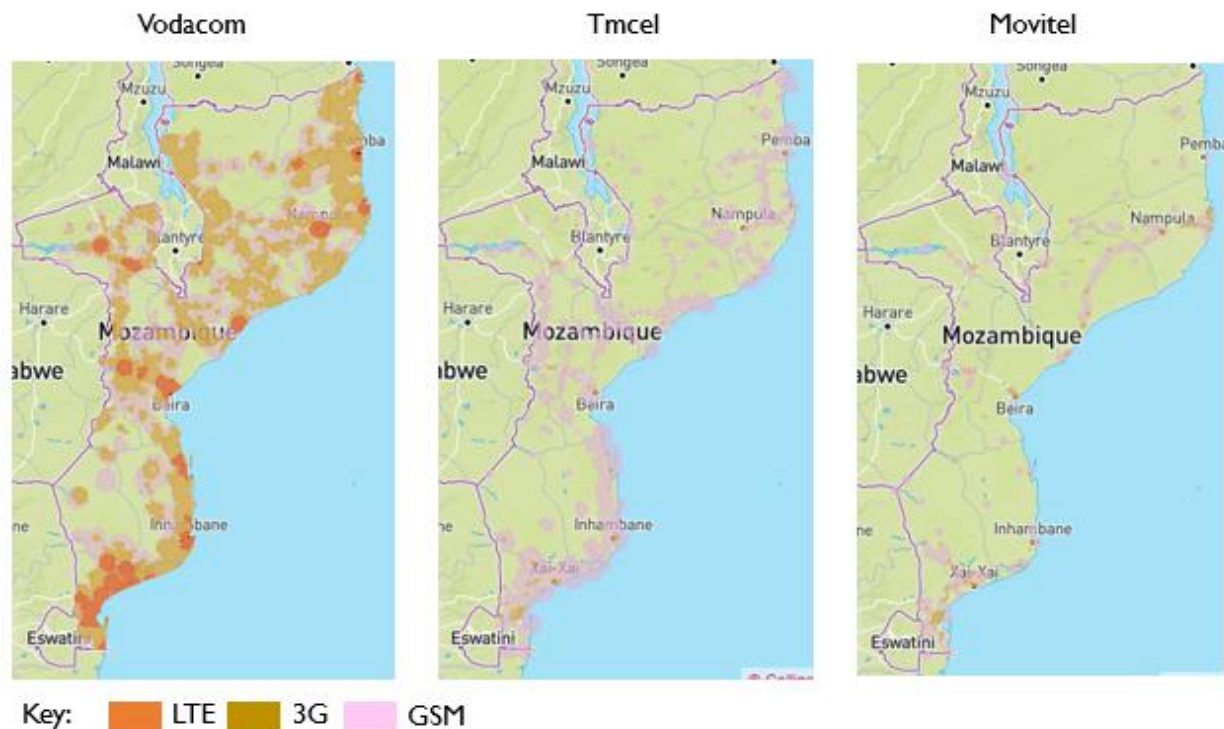
³⁴ ISP. 2023. *Mozambique's Telecommunications Market: Competitive Landscape and Analysis*. Online at: <https://isp.page/news/mozambiques-telecommunications-market-competitive-landscape-and-analysis/>

³⁵ International Trade Administration, Department of Commerce, USA. 2022. *Mozambique - Country Commercial Guide*. Online at: <https://www.trade.gov/country-commercial-guides/mozambique-information-and-communications-technology-ict>

³⁶ DCD. 2023. *Mozambique telco Tmcel at risk of collapse*. Online at: <https://www.datacenterdynamics.com/en/news/mozambique-telco-tmcel-at-risk-of-collapse/#:~:text=Tmcel%20is%20the%20third%20biggest,fewer%20than%20three%20million%20subscribers>

assessment and an analysis of INCM data,³⁷ has better rural coverage with cellular service generally than Vodacom. Anecdotally, quality of service among the three operators varies widely. Starlink, the satellite-based Internet provider run by SpaceX, announced a partnership in mid-2022 to provide broadband Internet access to Mozambique.³⁸ Starlink was licensed and active in Mozambique as recently as June 2023, however, the success and uptake of its services is yet to be seen, particularly given the relatively large price tag (\$600 for the requisite hardware plus a \$47 monthly subscription fee).³⁹ Figure 4 below shows the distribution of coverage of GSM, 3G, and LTE across the three operators.⁴⁰

Figure 3: Cellular coverage of the three major telecommunications operators



Note: adapted from <https://www.gsma.com/coverage/#3958>

A July 2023 article written on LinkedIn by a Data Governance Specialist working for the Mozambique telecommunications regulator, INCM, shows the status of cellular coverage as of March 2023, including a detailed breakdown of coverage of the three telecommunications operators.⁴¹ The article also shows which provinces are most likely to be using 2G, 3G, and 4G services. In Figure 5, the article lays out the distribution of coverage and

³⁷ LinkedIn. 2023. Reflexão Sobre a Cobertura de Telefonia Móvel em Moçambique (Março de 2023). Online at: <https://www.linkedin.com/pulse/reflex%25C3%25A3o-sobre-cobertura-de-telefonia-m%25C3%25B3vel-em-mo%25C3%25A7ambique-ap/?trackingId=mSILi5OXQ4%2BAKfElxY5mow%3D%3D>

³⁸ Africa News. 2022. SpaceX's Starlink Approved by Nigeria and Mozambique. Online at: <https://africanews.space/spacexs-starlink-approved-by-nigeria-and-mozambique/>

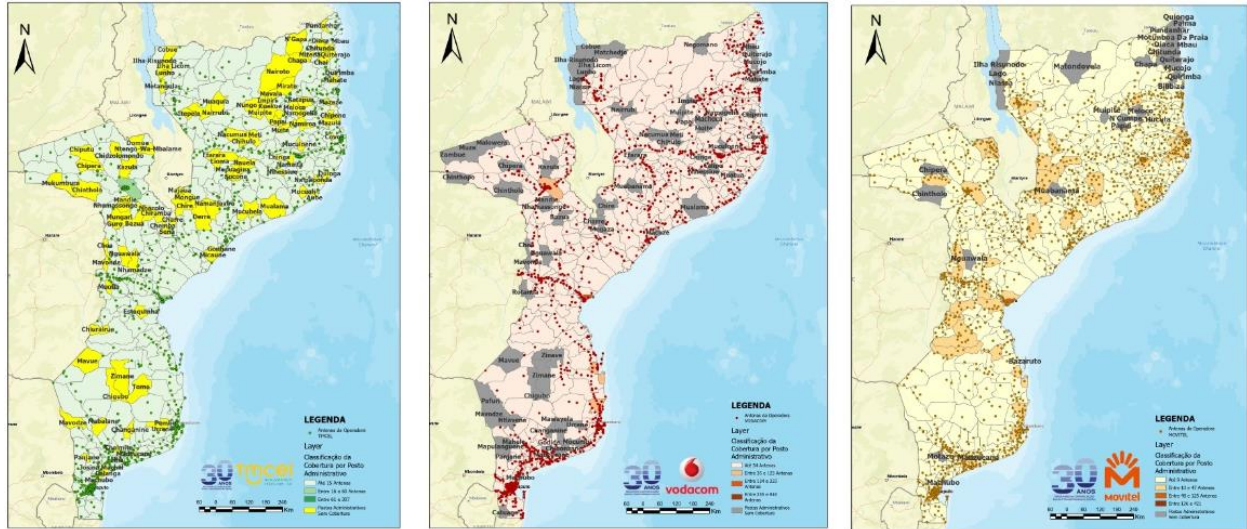
³⁹ Africa Briefing. 2023. Starlink launches officially in Mozambique, expanding satellite broadband services in Africa. Online at: <https://africabriefing.com/starlink-launches-officially-in-mozambique-expanding-satellite-broadband-services-in-africa/>

⁴⁰ GSMA. Network Coverage Maps. Online at: <https://www.gsma.com/coverage/#3958>

⁴¹ LinkedIn. 2023. Reflexão Sobre a Cobertura de Telefonia Móvel em Moçambique (Março de 2023). Online at: <https://www.linkedin.com/pulse/reflex%25C3%25A3o-sobre-cobertura-de-telefonia-m%25C3%25B3vel-em-mo%25C3%25A7ambique-ap/?trackingId=mSILi5OXQ4%2BAKfElxY5mow%3D%3D>

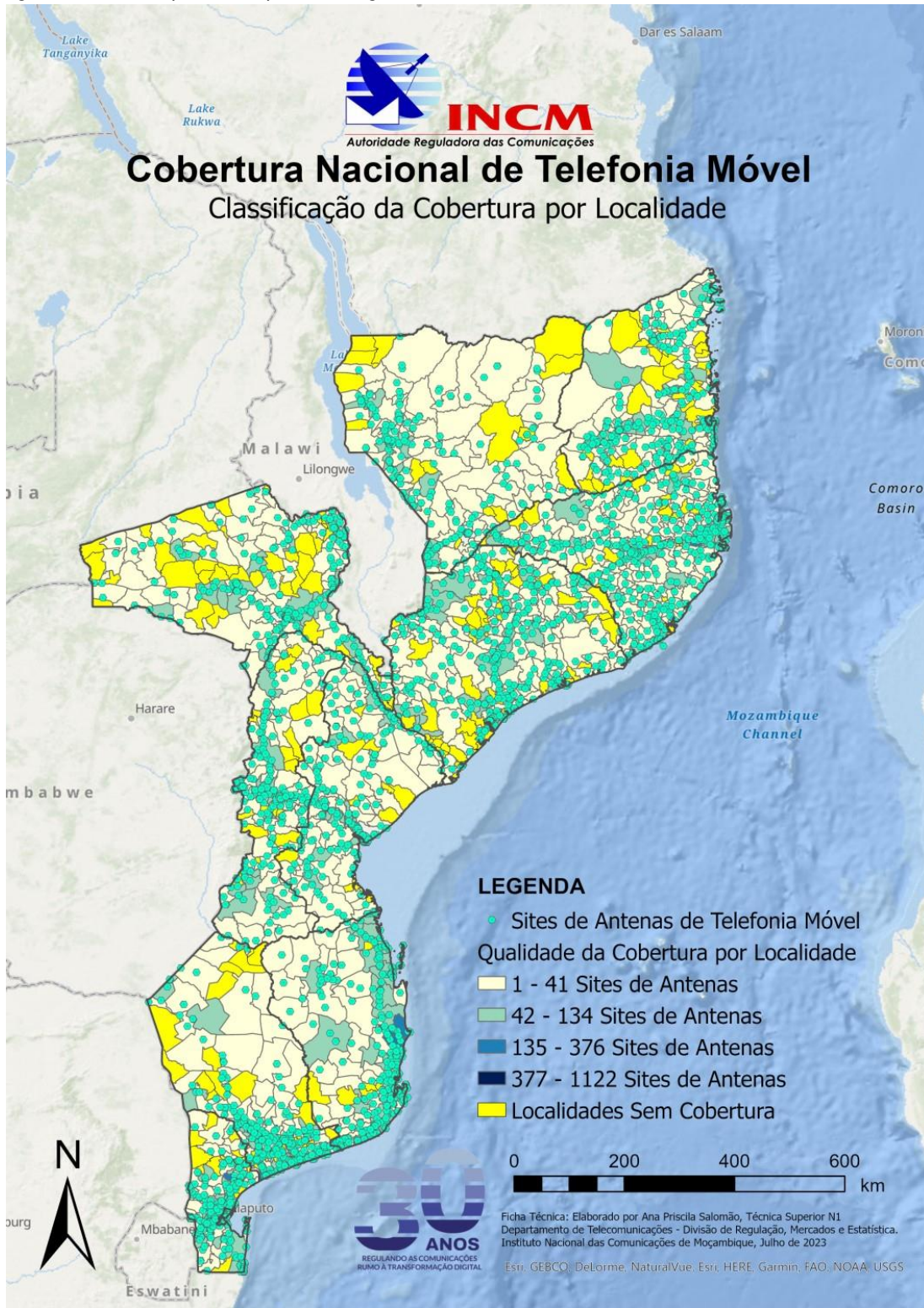
physical antennae for each of the three telecoms operators (from left to right: Mcel, Vodacom, Movitel) as of Q1 2022. In Figure 6, which comes from the article, areas without cellular coverage are in yellow. Tan, green, blue, and black areas represent areas of cellular coverage with progressively greater numbers of cellular towers covering those areas, respectively.

Figure 4: Cellular coverage of the three major telecommunications operators



Source: [https://www.linkedin.com/pulse/reflex%C3%A3o-sobre-cobertura-de-telefonia-m%C3%B3vel-em-mo%C3%A7ambique-
ap/?originalSubdomain=pt](https://www.linkedin.com/pulse/reflex%C3%A3o-sobre-cobertura-de-telefonia-m%C3%B3vel-em-mo%C3%A7ambique/?originalSubdomain=pt)

Figure 5: National map of cellular phone coverage



Source: <https://www.linkedin.com/pulse/reflex%C3%A3o-sobre-cobertura-de-telefonia-m%C3%B3vel-em-mo%C3%A7ambique-ap/?originalSubdomain=pt>

About half of the population owns a mobile phone, with affordability, digital illiteracy, and lack of electricity cited as a major factor in not owning one. At the beginning of 2023, there were 16.72 million cellular mobile connections (50 percent of the population), an increase of 9.0 percent year over year from 2022,⁴² though other estimates put the number well over 17 million as recently as late 2021.⁴³ Given the fact that many people tend to have more than one mobile phone, this statistic could be substantially lower (one 2016 USAID study found an average of 1.4 SIM cards per mobile subscriber).⁴⁴ As of 2023 data, web traffic was mostly conducted on mobile devices (57.8 percent), followed by laptops and desktop computers (40.6 percent). However, the dominance of mobile web traffic over laptop/desktop is a trend that has decreased over time, from a high of 85 percent of all web traffic in 2016 to a low of 55 percent in 2021. One-third of all cellular subscriptions are broadband (3G, 4G, 5G). Mozambique scores a 38.5 on GSMA's Mobile Connectivity Index, below the Sub-Saharan Africa average of 41.5. The Index measures variables related to a country's mobile infrastructure, affordability, consumer readiness, and content and services.⁴⁵ After Action's 2019 report on ICT trends in 16 countries across the Global South found that among those who did not own mobile phones in Mozambique, 36 percent reported the reason was a lack of access to electricity to charge their phones.⁴⁶ Data from 2020 reported by Statista indicated that affordability and data literacy are also major reasons for not owning a mobile phone.⁴⁷

Only about one in five Mozambicans uses the Internet, accessed almost universally via mobile broadband. As of January 2023, there were 6.92 million Internet users in Mozambique, accounting for 20.7 percent of the population, below the SSA average of 22 percent and ranked the tenth lowest Internet penetration rate in the world.⁴⁸ The year over year change between 2022 and 2023 in the total number of Internet users was 14 percent. About 36 percent of Internet users are also social media users (2.5 million social media users, or 7.5 percent of the population). Looking across gender, access to social media was not equitable: 42.5 percent of social media users were female and 57.5 percent male. The top social media platforms in Mozambique in January 2023 were Facebook (reaching 2.3m people), Instagram (394,000), Facebook Messenger (220,000), and Twitter (78,000). The vast majority of Internet users access the internet via mobile broadband: in 2021, there were 6.2 million mobile broadband subscriptions compared to 65,000 fixed broadband subscriptions, a 100 fold difference.⁴⁹ Figure 7 displays key Internet access statistics.

⁴² Datareportal. 2023. *DIGITAL 2023: MOZAMBIQUE*. Online at: <https://datareportal.com/reports/digital-2023-mozambique>

⁴³ TeleGeography. 2022. *Africa's Mobile Sector: Still Room for Growth*. Online at: <https://blog.telegeography.com/africas-mobile-sector-still-room-for-growth>

⁴⁴ USAID. 2016. *Mozambique Mobile Access and Usage Study Household Survey Results*. Online at: https://pdf.usaid.gov/pdf_docs/PA00MGDF.pdf

⁴⁵ GSMA. 2021. *GSMA Mobile Connectivity Index*. Online at: <https://www.mobileconnectivityindex.com/connectivityIndex.html#year=2021&zonesocode=MOZ&analysisView=MOZ>

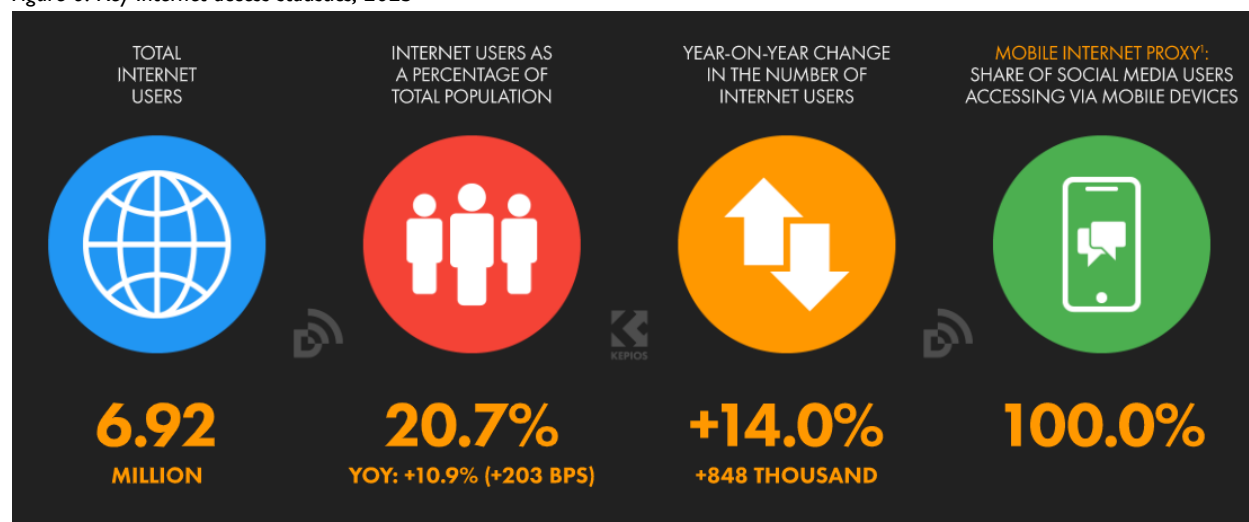
⁴⁶ Gillwald, A., et. al. 2019. *The State of ICT In Mozambique*. Online at: https://researchictafrica.net/wp/wp-content/uploads/2019/07/2019_After-Access_The-state-of-ICT-in-Mozambique.pdf

⁴⁷ Statista. *Mozambique: Which factor is the single most important reason stopping you from having a mobile phone?*. Online at: <https://www.statista.com/statistics/1272016/barriers-to-mobile-ownership-mozambique/>

⁴⁸ <https://datareportal.com/reports/digital-2023-april-global-statshot>

⁴⁹ ITU. 2022. *Fixed Broadband Subscriptions*. https://www.itu.int/en/ITU-D/Statistics/Documents/statistics/2022/December/FixedBroadbandSubscriptions_2000-2021.xlsx

Figure 6: Key Internet access statistics, 2023



Source: Datareportal 2023

Internet speeds, especially mobile, are high in Mozambique relative to Sub-Saharan Africa and have increased substantially in recent years. Median Internet speeds as of April 2023 were 39.77 Mbps (down), 10.18 (up), and with a latency of 28ms. The year over year change was 33 percent in download speeds and 19.3 percent in upload. The median speed of fixed Internet connections was 78.62 and 34.39, respectively, with a latency of 9ms; the year over year change was 29 percent and 33 percent, respectively. In January 2023, Mozambique's median mobile Internet speeds were 19.13 Mbps (about half the global median) with fixed Internet at 6.29 Mbps (60 percent of the global median). Mozambique's median download speed is substantially higher than the Sub-Saharan Africa average of 9.8 Mbps.⁵⁰ Speed capacity is increasing substantially faster in mobile than fixed: the median mobile Internet speed increased by 35 percent year over year from 2022 compared to just a 0.5 percent increase in fixed speeds.⁵¹ To put this discrepancy in context, Mozambique has the eighth largest gap among all countries worldwide in terms of difference between mobile Internet and fixed Internet speeds, with a ratio of 2.6:1 in favor of mobile.⁵²

Mobile handsets and data packages are relatively unaffordable in Mozambique. As of 2021, the price of the cheapest smartphone in Mozambique is \$15.65, which was about 37 percent of the average Mozambican's 2021 monthly income, well above the SSA average of 25 percent. According to one 2019 study by the World Bank, relatively high import duties on handsets and equipment contribute substantially to the cost.⁵³ Price for 1GB of data was varied: According to Cable.co.uk, who track mobile data pricing worldwide, as of March 2022, the average price of 1GB of cellular data is \$1.33,⁵⁴ or about 3.3 percent of the average Mozambican's monthly income, in line with the SSA average of 3.4 percent and ranking the country 105/223 globally and 18/49 in Sub-Saharan Africa.⁵⁵ ICT Africa's

⁵⁰ GSMA. 2023. *The State of Mobile Internet Connectivity 2023*. Online at: <https://www.gsma.com/r/somic/#regions>

⁵¹ Datareportal. 2023. *DIGITAL 2023: MOZAMBIQUE*. Online at: <https://datareportal.com/reports/digital-2023-mozambique>

⁵² Datareportal. 2023. *DIGITAL 2023 APRIL GLOBAL STATSHOT REPORT*. Online at: <https://datareportal.com/reports/digital-2023-april-global-statshot>

⁵³ The World Bank. 2019. *Mozambique Digital Economy Diagnostic Executive Summary Report*. Online at: <https://thedocs.worldbank.org/en/doc/833211594395622030-0090022020/original/MozambiqueDECA.pdf>

⁵⁴ Cable.co.uk. *Worldwide mobile data pricing: The cost of 1GB of mobile data in 237 countries*. Online at: <https://www.cable.co.uk/mobiles/worldwide-data-pricing/#regions>

⁵⁵ GSMA. 2022. *The State of Mobile Internet Connectivity 2022*. Online at: <https://www.gsma.com/r/wp-content/uploads/2022/12/The-State-of-Mobile-Internet-Connectivity-Report-2022.pdf>

Mobile Pricing Index, however, puts the lowest cost for 1GB of data at nearly 2.4 times higher (\$3.14 as of Q3 2022).⁵⁶ Though its data is from 2017, the After Access 2019 survey indicated that 78 percent of Mozambicans who did not own phones reported the cost of the phone itself as the main reason why. Among those who did not use smartphones, 64 percent cited the price of a smartphone as the main reason.⁵⁷

According to 2022 data from ITU, the basket of fixed broadband services accounted for 33.7 percent of the per capita monthly GNI in Mozambique (Africa average: 16.0; global average: 2.6), compared to a low of 9.35 percent for data-only mobile broadband (Africa average: 3.2; global average: 1.0) and a high of 18.7 percent for mobile broadband with high data and voice consumption (Africa average: 9.3; global average: 2.3).⁵⁸ In GSMA's Mobile Connectivity Index, Mozambique scores 43.0, above the Sub-Saharan Africa average of 39.5.⁵⁹ In its 2022 Network Readiness Index, the WEF ranks Mozambique 119/133 in terms of mobile handset prices and 121/133 in mobile tariffs,⁶⁰ though the recent completion of two undersea broadband cables have substantially reduced mobile tariffs in the country in recent years.⁶¹

There is a large gap in gender and rural-urban with respect to use of ICTs in Mozambique. According to 2017 data from the International Telecommunications Union (ITU), Internet users in Mozambique were 1.57 times more likely to be male than female. In urban areas, this statistic was 1.45x; in rural areas it was 1.89x.⁶² Further, 2017 data indicated that males were 1.42 times more likely to own a mobile phone.⁶³ WEF's Network Readiness Index for 2022 ranks Mozambique 118th out of 133 countries in its "Inclusion" category; with very low scores in availability of local online content and socioeconomic gap in use of digital payments (ranks 126 and 115, respectively). The country ranks 99th in gender gap in Internet use, 94th in E-participation, and somewhat middle of the road in terms of rural gap in use of digital payments (60th).⁶⁴ Table 6 below shows the rural-urban divide, or the percentage difference in urban versus rural families using a given ICT.

⁵⁶ Research ICT Africa. *Research ICT Africa Mobile Pricing (RAMP)*. Online at: <https://researchictafrica.net/research-ict-africa-ramp-index-2/>

⁵⁷ Gillwald, A., Mothobi, O., & Rademan, B. (2019). *The State of ICT in Mozambique* (Policy Paper No. 6; Series 5: After Access – Assessing Digital Inequality in Africa). Research ICT Africa. https://researchictafrica.net/wp/wp-content/uploads/2019/07/2019_After-Access_The-state-of-ICT-in-Mozambique.pdf

⁵⁸ ITU. *Digital Development Dashboard*. Online at: <https://www.itu.int/en/ITU-D/Statistics/Dashboards/Pages/Digital-Development.aspx>

⁵⁹ GSMA. 2021. *GSMA Mobile Connectivity Index*. Online at: <https://www.mobileconnectivityindex.com/connectivityIndex.html#year=2021&zonsocode=MOZ&analysisView=MOZ&comparison=1&geographys=MOZ,XHA&metricsIndex=affordability&years=2021>

⁶⁰ POTULANS Institute. 2022. *Network Readiness Index – Performance Overview*. Online at: <https://networkreadinessindex.org/country/mozambique/>

⁶¹ The World Bank. 2019. *Mozambique Digital Economy Diagnostic Executive Summary Report*. Online at: <https://thedocs.worldbank.org/en/doc/833211594395622030-0090022020/original/MozambiqueDECA.pdf>

⁶² ITU. 2022. *Individuals Using Internet by Gender & Urban-Rural*. Online at: <https://www.itu.int/en/ITU-D/Statistics/Documents/statistics/2022/December/IndividualsUsingInternetByGender%26Urban-Rural.xlsx>

⁶³ ITU. *Digital Development Dashboard*. Online at: <https://www.itu.int/en/ITU-D/Statistics/Dashboards/Pages/Digital-Development.aspx>

⁶⁴ POTULANS Institute. 2022. *Network Readiness Index – Performance Overview*. Online at: <https://networkreadinessindex.org/country/mozambique/>

Table 8: Percentage of households using ICT

ICT	National (%)	Urban (%)	Rural (%)
Landline	1	2	0.1
Desktop	2	5	0.3
Laptop	4	7	1
Tablets	8	15	4
Television	23	40	10
Radio	37	40	35

Source: RIA After Access survey data, 2017

Digital Society, Rights, and Governance

Mozambique's ICT governance measures are consistently ranked near the bottom globally. WEF's Network Readiness Index for 2022 ranks Mozambique 120 out of 133 countries in terms of ICT Governance. The measure includes components of trust, regulation, and inclusion. Under trust, Mozambique scores 117/133 in secure Internet servers and 112/133 in cybersecurity while under the regulation component the country ranked 109th in both regulatory quality and ICT regulatory environment and 118th in E-commerce legislation. Under the People pillar, government scores are equally low, with the Index placing Mozambique 115th among all countries, including 115th rank in promotion of investment in emerging technology, 100th in publication and use of open data, and 99th in government online services.⁶⁵

The regulatory environment for ICT has slowly improved in recent years. The International Telecommunications Union (ITU) ICT Regulatory Tracker assesses the regulatory quality for digital services in a country using 50 indicators across four pillars: regulatory authority, mandate, regime, and competitive framework. For 2022, Mozambique scored 70/100, putting it at the very lower band of a Generation 3 country (out of Generation 1-5) or one that has “enabling investment, innovation and access – dual focus on stimulating competition in service and content delivery, and consumer protection.” The country scored highest under the “Regulatory Regime” sub-component with 23 out of a possible maximum of 25 points. Overall, Mozambique ranked 124th out of 193 countries globally and 28th out of 44 in Africa.⁶⁶

There are a number of relevant policies that mention agriculture and/or digital on the books in Mozambique. The National Agriculture Investment Plan 2014-2018 (PNISA) refers to digital payment systems, including e-vouchers. The National ICT Policy of 2006 highlights online agriculture extension services, basic computer training to farmers, and encourages farmers to participate in marketing online. The National Information Society Policy of 2018 mentions four areas in which ICTs can be used to improve agriculture such as monitoring market performance and price, promoting knowledge to ensure equitable access to improved farming techniques, establishing GIS to mitigate emergencies and improve environmental management, and promoting improved communication systems. The Strategic Plan for the Information Society 2019-2028 outlines the following priorities: access to technologies to increase technical knowledge, access to markets and adoption of technologies that enable modern practices, increasing digital skills, encouraging the low cost of access to networks and mobile data and access to information sharing equipment. The policy also has a major outcome of 50 percent of farmers and buyers using electronic payment systems by 2028. Three additional important laws and policies relevant to digital and agriculture include MADER's Rural Finance Strategy (though not yet approved, an essential policy initiative for the digital agri-tech ecosystem), Decree 32/2017 of 2017 (the regulation for interoperability between mobile money operators), and the implementation of the Government's Economic Acceleration Package (August 2022) which reduces the Corporate Income Tax (IRPC) for the agriculture sector from 32% to 10%. Mozambique has a universal service access fund (USAF), managed by the National Communications Institute of Mozambique (INCM) and funded by one percent of telecommunications operators gross revenue each year. In 2018, through USAF, INCM began to set up Internet plazas throughout the country in which citizens could access and use the Internet for free. While it was reported that one million people accessed these plazas in 2019,⁶⁷ no stakeholders interviewed mentioned working with the USAF or its status today.

A host of public agencies and regulators oversee the ICT sector leading to confusion as to whom to approach for ICT-related efforts. Oversight of ICT sector priorities falls between two ministries: the Ministry of Transport and

⁶⁵ POTULANS Institute. 2022. *Network Readiness Index – Performance Overview*. Online at: <https://networkreadinessindex.org/country/mozambique/>

⁶⁶ ITU. *ICT Regulatory Tracker*. Online at: <https://app.gen5.digital/tracker/country-cards/Mozambique>

⁶⁷ CIPESA. *Digital Rights in Mozambique*. Online at: https://cipesa.org/?dl_name=documents/Submission-to-the-38th-session-of-the-Universal-Periodic-Review-Mozambique.pdf

Communications, including its regulator INCM (which is responsible for all telecommunications in the country) and the Ministry of Science and Technology, Higher and Technical Vocational Education (MCTESTP), responsible for implementing ICT policy and the E-Government strategy, along with its ICT regulator the National Institute of Information and Communications Technologies (INTIC). There is general consensus that the enabling environment for ICTs has improved in recent years, particularly after the passing of the new Telecommunications Law in 2016 that installed safeguards to combat anti-competitive behavior. Created in 2017, the National Institute of Electronic Government (INAGE) (within the Ministry of Science and Technology) is responsible for implementing the country's strategy for digitization of government. One of INAGE's mandates is to manage the interoperability platform for E-government. A 2019 World Bank study on digital economy noted that the addition of INAGE to INMC and INTIC has resulted in some confusion over agency roles with respect to ICT management and oversight.⁶⁸

Interoperability of telecommunications operators and infrastructure is enshrined in law but not carried out in practice. In 2016 and 2017, the government passed the Regulation of Telecommunication Regulatory Fees, the Regulation of Licensing of Telecommunications and Scarce Resources, and the Regulation of Interconnection of Telecommunications Networks. These three policies helped to establish licensing regulations and, along with the 2018 Regulation of Telecommunication Infrastructure and Network Resource Sharing, encouraged infrastructure sharing. As a result of these policies, telecommunications operators must share infrastructure if asked, contributing to better cost efficiencies and improving the viability of reaching rural populations. While promising, anecdotal evidence from 2018 indicates that the three major telecommunications operators do not often actively engage in infrastructure sharing due to consistent poor quality network issues for some of the operators.⁶⁹

Mozambique has a host of e-governance service delivery platforms built mostly along the lines of donor funding cycles. The systems are generally uncoordinated and not interoperable. The laws that set forth interoperability regulations include Decree N° 14/2007 for the “Bau” services, Law N° 3/2017 - Law of Electronic Transactions (Lei de Transações Eletrônicas), Decree N° 67/2017 - (Quadro de Interoperabilidade do Governo). In June 2023, the Ministry of Economy and Finance announced it would be rolling out the electronic business licensing portal, known as the e-BAU system, as a one-stop shop for business licensing.⁷⁰ The Mozambican government has a number of internal-facing digital platforms to manage public services from civil registration, to motor vehicles, property registration, business licensing, and taxation. Many of these systems, however, were built according to donor funding cycles and their maintenance and performance remain variable.⁷¹ An open source analysis of agriculture-related e-government portals found the vast majority to be internal-facing as opposed to offering external access for service delivery. All eight active platforms were accessible through standalone desktop applications/portals, five had an accompanying smartphone application, and only one (ConnectCaju) had SMS/USSD capabilities. The active e-government service portals related to agriculture are presented in Table 7 below.

Table 9: E-government portals active in Mozambique as of 2022

Portal	Department	Description
CUPA	MADER/FAR	Extension worker logistics software at MADER.

⁶⁸ The World Bank. 2019. *Mozambique Digital Economy Diagnostic Executive Summary Report*. Online at: <https://thedocs.worldbank.org/en/doc/833211594395622030-0090022020/original/MozambiqueDECA.pdf>

⁶⁹ The World Bank. 2019. *Mozambique Digital Economy Diagnostic Executive Summary Report*. Online at: <https://thedocs.worldbank.org/en/doc/833211594395622030-0090022020/original/MozambiqueDECA.pdf>

⁷⁰ Further Africa. 2023. *Mozambique makes starting a business easier, eliminates license requirement*. Online at: <https://furtherafrica.com/2023/06/11/mozambique-makes-starting-a-business-easier-eliminates-license-requirement/>

⁷¹ The World Bank. 2019. *Mozambique Digital Economy Diagnostic Executive Summary Report*. Online at: <https://thedocs.worldbank.org/en/doc/833211594395622030-0090022020/original/MozambiqueDECA.pdf>

Portal	Department	Description
SIMA	MADER/DCM	Internal gov platform to analyze prices and market trends; pilot project to scale up to USSD/SMS and partner with telecoms.
ATR	MADER/DNDP	Manages transporter licenses to transport animals.
RELI	MADER/DNDP	Software to manage import and export of animals.
e-BAU	MEF	Online business licensing portal, opening in July 2023. ⁷²
ConnectCaju	MADER/IAM	Helps ministry level track and register cashew farmers, cashew harvest and seedlings, for better extension services. Includes weather services.
SIGIT	MTA/DNAF/ DNAT	Land management software; full life cycle of plot ownership; Geo portal coming soon.
SIREM	MIC/BMM	A system in development to track commodity prices nationwide. Not yet operational but will have a website and app.
SIF	MTA/DNAF	Internal software that allows management of forest resources (licensing, registration, etc.).

There are recent efforts to digitize mobile registration, though they may act as barriers to increasing coverage. In April 2023, the Regulatory Authority for Communications of Mozambique (INCM) passed Decree 13/2023 requiring biometrics (e.g., fingerprints or facial scan) and identification documents (e.g., drivers license) when registering new mobile subscriptions. The new process will assign a Unique Telecommunications Number (NUTEL) to each subscriber, with the goal of both automating and digitizing the process and reducing fraud.⁷³ Anecdotally, most rural inhabitants lack the proper documentation needed to register; therefore, such a system could further hamper efforts to increase access to mobile technology.

There is substantial legislation with respect to digital consumer protection, however no evidence to show that the legislation is enforced. In the areas of data privacy and cybersecurity, Mozambique has several policy-level instruments in place: Article 71 of the Constitution granting the right of privacy to all individuals, Mozambique's participation in the African Union's Convention on Cyber Security and Data Protection, and the Electronic Transactions Act of 2017 which lays out legal protections for users of ICT. The World Bank's review of these areas in 2018 however indicated there was little to no enforcement of these mechanisms.⁷⁴ The above mentioned push to use biometric measures and extensive documentation to register for SIM cards was passed in an attempt to limit fraud and cybercrime.

⁷² Further Africa. 2023. *Mozambique makes starting a business easier, eliminates license requirement*. Online at: <https://furtherafrica.com/2023/06/11/mozambique-makes-starting-a-business-easier-eliminates-license-requirement/>

⁷³ Club of Mozambique. 2023. *Biometric registration of SIM cards and other changes on their way | Mozambique*. Online at: <https://clubofmozambique.com/news/biometric-registration-of-sim-cards-and-other-changes-on-their-way-mozambique-236230/>

⁷⁴ The World Bank. 2019. *Mozambique Digital Economy Diagnostic Executive Summary Report*. Online at: <https://thedocs.worldbank.org/en/doc/833211594395622030-0090022020/original/MozambiqueDECA.pdf>

Digital Economy

Digital finance

Access to and use of digital finance is varied in Mozambique, and highly inequitable between men and women. Mozambicans have varied access to financial services from a high of 39.4 percent making a digital payment in the previous year to a low of 4.9 percent making a purchase using a mobile phone or the Internet in the past year. Nearly four in ten (38.6 percent) have an account with a financial institution, and just under three in ten (29.4 percent) have a mobile money account. Given the ten percentage point gap in percent making a digital payment and percent having a mobile money account, a substantial portion of digital payments in Mozambique appear to be made over the counter. Across all financial access indicators, males vastly outperform females, indicating a substantial gender divide when it comes to access to finance and specifically access and use of finance in the digital space.⁷⁵ According to the After Access 2019 survey data, 63 percent of mobile phone users in urban areas use mobile money while only 29 percent of users in rural areas do so.⁷⁶ According to the FAO, "Financial institutions have limited outreach in rural areas, charge unaffordable interest rates and require guarantees and other conditions that effectively exclude small farmers from getting credit."⁷⁷ A 2022 GIZ study found that men were 54 percent more likely to have a bank account, 54 percent more likely to have a mobile money account, and 116 percent more likely to have access to credit compared to women in Mozambique.⁷⁸ Table 8 and Figure 8 below lay out basic access to finance indicators, particularly related to digital payments.

Table 10: Key financial access indicators

Indicator	Total	Female	Male
Account with a financial institution	38.6%	30.8%	47.0%
Credit card ownership	10.9%	6.0%	16.1%
Debit card ownership	18.0%	11.6%	24.7%
Mobile money account	29.4%	21.5%	37.8%
Made a digital payment in the past year*	39.4%	27.8%	51.7%
Made a purchase using a mobile phone or the Internet in the past year*	4.9%	4.0%	5.9%
Used a mobile phone or the Internet to send money in the past year*	25.0%	17.8%	32.6%
Used a mobile phone or the Internet to pay bills in the past year*	16.0%	11.5%	20.7%

*Note that making a digital payment is characterized as paying a bill or engaging in e-commerce, which is separate from sending money to others via a mobile or digital wallet.

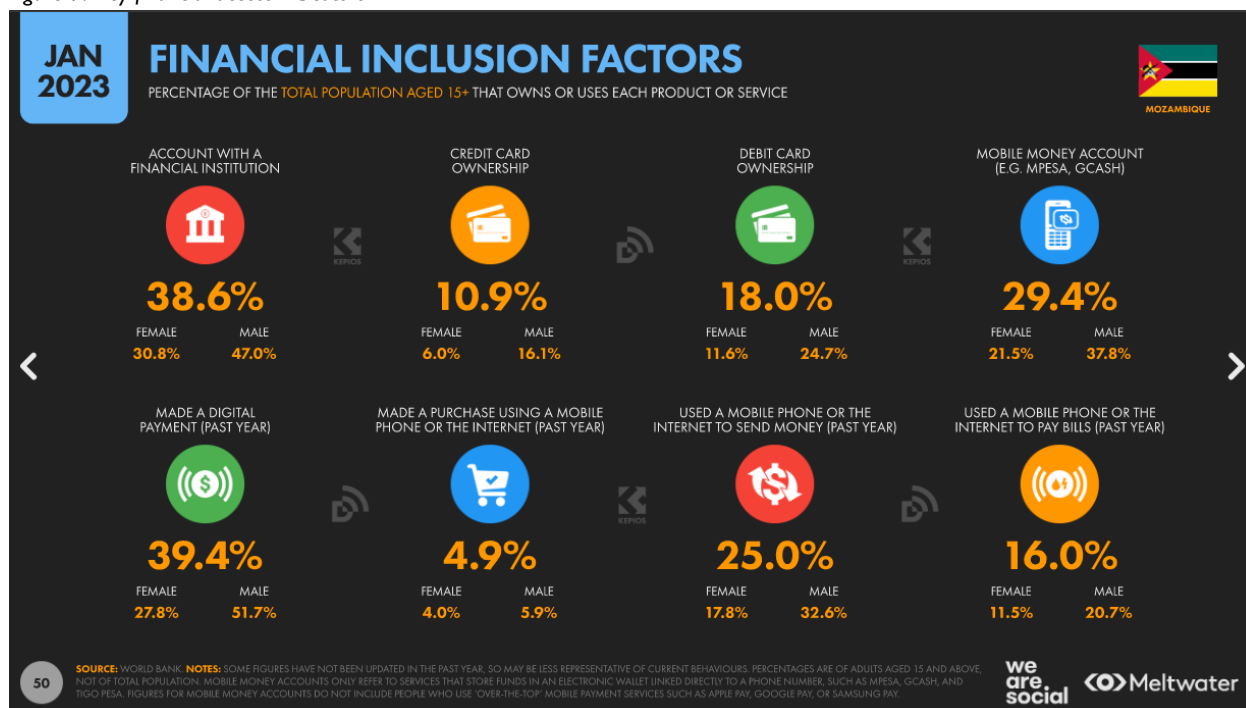
⁷⁵ Datareportal. 2023. DIGITAL 2023: MOZAMBIQUE. Online at: <https://datareportal.com/reports/digital-2023-mozambique>

⁷⁶ Gillwald, A., et. al. 2019. *The State of ICT In Mozambique*. Online at: https://researchictafrica.net/wp/wp-content/uploads/2019/07/2019_After-Access_The-state-of-ICT-in-Mozambique.pdf

⁷⁷ FAO, European Union and CIRAD. 2022. *Food Systems Profile - Mozambique. Catalysing the sustainable and inclusive transformation of food systems*. <https://doi.org/10.4060/cc0498en>

⁷⁸ Saranga, Tanhia. *Diferenças de Género no Acesso a Produtos e Serviços Financeiros, Maputo: GIZ, December 2022.*

Figure 7: Key financial access indicators



Source: Datareportal, 2023

Smallholder farmers access finance (digital or otherwise) at very low rates. Results of MADER’s 2020 Agrarian survey, show that only 0.6 percent of SHF have ever accessed credit, 15 percent have a bank account, and 36 percent have a mobile money account, with distribution highly inequitable across the country’s provinces. PREMIER’s 2023 assessment of the financial ecosystem for agriculture⁷⁹ confirmed that banking credit to the agriculture sector is limited almost exclusively to large and medium producers and agribusinesses. As of June 30, 2023, the country’s prime lending rate was 24.10 percent,⁸⁰ well above the average profit margin for producers and agribusiness and well above the 10 percent that many in the sector say is too difficult to repay.⁸¹ Generally, credit for the sector comes from internal actors (input suppliers, agro dealers, processors, buyers, exporters, etc.) or from MADER itself in the form of subsidies, grants, and direct distribution of free inputs. According to a 2016 CGAP report, smallholder farmers in Mozambique have very little savings, access to credit or insurance and thus limited ways to mitigate risk.⁸² Transactions are still mostly made in cash in rural areas,⁸³ though recent studies have shown increasingly greater uptake in digital payments, particularly among savings groups.⁸⁴ Major challenges, as highlighted in the World Bank’s 2019 Digital assessment (and which remain relevant today), include: “limited

⁷⁹ FTF PREMIER. Financial Ecosystem Mapping. May 2023.

⁸⁰ Bank of Mozambique. Online at: <https://www.bancomoc.mz/>

⁸¹ FTF PREMIER. Financial Ecosystem Mapping. May 2023.

⁸² CGAP. 2016. *National Survey and Segmentation of Smallholder Households in Mozambique - Understanding Their Demand for Financial, Agricultural, and Digital Solutions*. Online at: <https://www.cgap.org/sites/default/files/Working-Paper-National-Survey-and-Segmentation-Mozambique-March-2016.pdf>

⁸³ The World Bank. 2019. *Mozambique Digital Economy Diagnostic Executive Summary Report*. Online at: <https://thedocs.worldbank.org/en/doc/833211594395622030-0090022020/original/MozambiqueDECA.pdf>

⁸⁴ FTF PREMIER. Financial Ecosystem Mapping. May 2023.

penetration of mobile services and bank branches outside urban centers; limited awareness of and trust in the digital money transfers provided by agents; the absence of agents with enough cash liquidity, particularly in rural areas; and, limited acceptance by merchants of digital payments.”⁸⁵ Table 9 below lays out basic access to finance indicators for smallholder farmers from the 2020 MADER agrarian survey.

Table 11: Basic access to finance indicators for SHF

Indicators for smallholder farmers	Total
Accessed credit in the past 12 months	0.6%
Participate in savings groups	8.9%
Have a bank account	15.0%
Have M-Pesa account	32.9%
Have e-Mola account	2.9%
Have M-Kesh account	0.2%
Use a mobile account	3.8%

Source: 2020 MADER Agrarian Survey

Mozambican policy supports the growth of digital financial services. In 2016, the country passed a five-year National Financial inclusion Strategy which lays out, among many things, the importance of involving rural communities in the formal financial system. The report highlights the need for expanding financial access points to rural areas, incentivizing new bank accounts and savings groups, and increasing financial literacy. The report proposes reaching a goal of 60% of the adult population with physical or electronic access to financial services offered by a formal financial institution.⁸⁶ The Government of Mozambique’s Financial Sector Development Strategy 2013-2022 also highlights digital payment systems, digital banking, and collateral registries and credit information systems.

Digital literacy and skills

Digital literacy remains very low in the country, stifled primarily by lackluster education indicators.

According to the 2019 After Access survey, 14 percent of those who did not access the Internet in Mozambique were unable because they did not know how.⁸⁷ The Wiley Digital Skills Gap Index (see Figure 9), which reflects how advanced and prepared an economy is with respect to digital skills, places Mozambique second to last out of 134 countries globally and last out of 26 Sub-Saharan countries. The index incorporates variables such as digital skills upon graduation, years of schooling, staff training, importance of ICT in government vision, STEM graduates, and others.⁸⁸

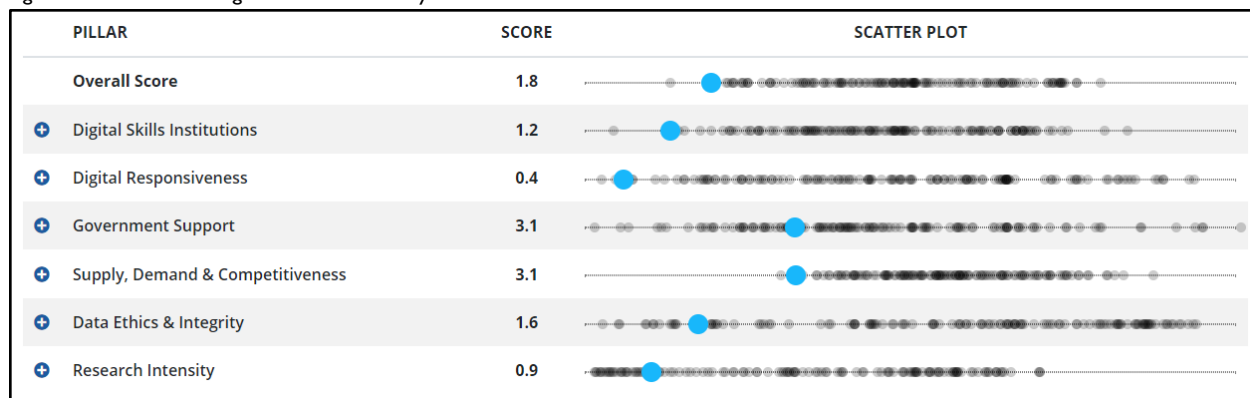
⁸⁵ The World Bank. 2019. *Mozambique Digital Economy Diagnostic Executive Summary Report*. Online at: <https://thedocs.worldbank.org/en/doc/833211594395622030-0090022020/original/MozambiqueDECA.pdf>

⁸⁶ The World Bank and Republic of Mozambique. *National Financial inclusion Strategy, 2016-2022*. Online at: <https://pubdocs.worldbank.org/en/469371468274738363/mozambique-national-financial-inclusion-strategy-2016-2022.pdf>

⁸⁷ Gillwald, A., et. al. 2019. *The State of ICT In Mozambique*. Online at: https://researchictafrica.net/wp/wp-content/uploads/2019/07/2019_After-Access_The-state-of-ICT-in-Mozambique.pdf

⁸⁸ WILEY. *The Digital Skills Gap Index (DGSi)*. Online at: <https://dsgi.wiley.com/global-rankings/>

Figure 8: Indicators on digital skills and literacy



Source: Wiley Digital Skills Gap Index: Mozambique⁸⁹. All scores are out of 10.

The Global Talent Competitiveness Index (GTCI) ranks Mozambique 127/133; the country suffered the largest reduction in score of any single country between the current (2022) and former (2018) GTCI. While the index has several components, Mozambique placed 132/133 countries in the “Grow” category, including ranking 125/133 in use of virtual social networks and 122/133 in use of virtual professional networks. The GTCI also ranks Mozambique 131/133 in “Global Knowledge Skills,” including a 125th ranked position for workforce with tertiary education.⁹⁰ The GCI 4.0: Digital skills among population Index ranks the country 139/144 as of 2019, down from 124th two years prior.⁹¹ The World Economic Forum (WEF) Network Readiness Index places Mozambique 128th in the “Individuals” pillar, noting a particularly low score for ICT skills in the education system (ranked 128th).⁹² Digital indicators related to job creation from the WEF NRI include relatively low tertiary enrollment levels (3.51 percent of the population) and tertiary education expenditure (ranking 96/133). See Table 12 below for additional indicators:

Table 12: Indicators on digital skills and literacy

		Score	Rank
3	GROW	8.05	131
3.1	Formal Education	5.40	118
	Enrolment		
3.1.1	Vocational enrolment	14.28	71
3.1.2	Tertiary enrolment	3.81	115
	Quality		
3.1.3	Tertiary education experience	3.50	96
3.1.4	Reading, math and science	n/a	n/a
3.1.5	University ranking	0.00	76
3.2	Lifelong Learning	12.15	131
3.2.1	Business masters education	0.00	54
3.2.2	Prevalence of training in firms	18.18	80
3.2.3	Employment development	18.28	131

⁸⁹ WILEY. *Economy/Location Profile*. Online at: <https://dsgi.wiley.com/economy-location-profiles/>

⁹⁰ INSEAD. 2022. *The Global Talent Competitiveness Index 2022*. Online at: <https://www.insead.edu/sites/default/files/assets/dept/fr/gtci/GTCI-2022-report.pdf>

⁹¹ The World Bank. *Digital skills among population*. Online at: https://tcdata360.worldbank.org/indicators/h945a9708?country=MOZ&indicator=41547&viz=line_chart&years=2017,2019

⁹² POTULANS Institute. 2022. *Network Readiness Index – Performance Overview*. Online at: <https://networkreadinessindex.org/country/mozambique/>

		Score	Rank
3.2.4	Formal and non-formal studies	n/a	n/a
3.3	Access to Growth Opportunities	6.59	133
	Empowerment		
3.3.1	Delegation of authority	12.42	126
3.3.2	Youth inclusion	n/a	n/a
	Collaboration		
3.3.3	Use of virtual social networks	5.32	125
3.3.4	Use of virtual professional networks	203	122

Source: <https://networkreadinessindex.org/country/mozambique/>

DIGITAL AGRICULTURE

In the following section, we focus on the state of digital agriculture in Mozambique informed by primary interviews with stakeholders and secondary research. The section is broken down into two subsections: demand-side factors and supply-side services. The supply-side section contains several case studies in digital agriculture and digital finance.

Demand-side Considerations

In this section we focus on demand-side factors, including barriers and facilitators, for uptake and creation of services with respect to digital interventions and digital finance for the agriculture sector. Demand-side factors are split into three sub-sections: information and knowledge, economic and financial considerations, and public sector considerations.

Information and Knowledge

Farmers lack basic information on agriculture. Across the five farmer cooperatives interviewed, respondents on the whole (4/5) indicated first and foremost information asymmetry with respect to late delivery of inputs (seeds and fertilizer) and the right time to start planting (informed by weather patterns), followed by information on pest control (3/5) and weather (2/5). Two of five cooperatives indicated a lack of support in terms of linkages to markets to sell goods, with another two indicating climate change and weather continues to “devastate [the] entire production.” Several key informants confirmed findings from cooperatives, with many corroborating a general lack of improved seeds and fertilizer use, information on when to plant, limited extension services, and little to no rain data or weather prediction services. Many farmers use slash and burn to clear new areas, which is the main driver of deforestation in the country and a contributor to climate change.

Farmers appear generally unknowledgeable and skeptical of ICT solutions. When asked about ICT for agriculture, all five cooperatives expressed they were unaware of any ICT solutions, and extension services received to date offered no insight in this area. Four key informants indicated that farmers generally do not trust technology. Reasons given included the failure of past donor projects that created unsustainable solutions, a general mistrust of handing over money to a third party (in the case of mobile money), or a lack of confidence in the ability to utilize ICT, especially among older farmers. Only one of five cooperatives interviewed for this assessment indicated a willingness to support new ICT initiatives: “if technology can help in the delivery of inputs and avoid the loss of products, it would be a good thing for the association.” Along the same vein, one of five cooperatives had a member who owned a smartphone to support more advanced ICT solutions and one of five cooperatives was aware of mobile money (e-Mola). A 2023 financial inclusion study carried out by the USAID PREMIER project identified myriad farmer and savings groups utilizing mobile money, though the study was limited to two provinces only.

Farmers receive information mostly from radio and (infrequent) extension services. Most cooperatives (4/5) indicated that radio and extensionists were their best source of information for agriculture. A

national stakeholder in academia confirmed that “radio in local languages is the most powerful and encompassing form of communication in the country.” While farmer cooperatives interviewed indicated having received visits from extensionists, a 2020 agrarian survey by MADER indicated that less than 10 percent of SHFs had received any visit in 2019. Regardless of having received extension visits, three stakeholders familiar with extension services expressed that government extension workers were not yet trained sufficiently in digital agriculture services. A key informant from a national NGO felt that “disseminating information via mobile phones can help a lot to correct these failures in agricultural extension services.”

Low literacy, low financial literacy, and low digital literacy were cited most often as barriers to uptake of digital agriculture and digital financial services among farmers. Nearly half of key informants mentioned these factors, which are highly interlinked given that low general literacy is a key root cause of low financial and digital literacy. As farmers complete fewer and fewer years of schooling, they are less likely to gain higher socioeconomic status, learn the basics of financial management, and own and operate digital assets. Financial institutions in particular were reluctant to lend to producers who lacked business-related skills. Mobile money operators cited producers’ inability to understand the use of phones and technology as a barrier to uptake of mobile money. According to one mobile money operator, “people can’t read and don’t master the technologies.”

Economic and Financial Considerations

Farmers that use mobile money report important benefits from its use. Among those farmers that utilize mobile money, the most commonly cited benefits for both men and women were security--not having to worry about storing, traveling with, or theft of physical money, followed by reduced travel times to withdraw or deposit money as a secondary benefit (particularly among women), and access to credit (for men). Security of cash--cash transactions still make up a large majority of transactions among farmers-- is a major concern for farmers; as one mobile money operator stated, “There is a strong culture of keeping money under the mattress at home.” While mobile money did not necessarily solve the problem of collateral, it provides an interesting opportunity to integrate digital asset registries currently being explored in the country.

There are substantial barriers and risks for the private sector to make money in the digital agriculture space. A major barrier noted by several private companies implementing or attempting to implement digital solutions was fees charged by financial institutions to conduct transactions. According to two interviews, SIMO, the association of banks, in participation with the Central Bank, charged relatively high fees to mobile operators. At the same time, USAID PREMIER’s May 2023 study on financial access found that limited formal linkages between producers and other value chain actors, in the form of contracts or other collateral, along with climate shocks, pests, and poor quality products meant investment in the sector was high risk for financial institutions. High population dispersion in rural areas means less viability in economies of scale for the private sector. Mobile money operator agent networks do not have adequate coverage in rural areas due to high population dispersion and a perceived low return on investment.

Cost is a barrier to uptake and scale of digital solutions. Five key informants interviewed noted cost as a barrier across several different stakeholder groups. From an investor perspective, two informants stated that in their experience, digital agriculture solutions did not provide a value proposition worth investing in. Three informants indicated the need for regulatory reforms to substantially reduce the transaction costs associated with mobile money. The high relative cost of data packages for mobile in Mozambique acts as a producer-side barrier for accessing the Internet and using basic services such as sending SMS or utilizing USSD services.

Savings groups are extremely popular in Mozambique and offer access to finance for SHFs. Savings groups are typically made up of between 10 and 30 members who contribute certain amounts of money to a common lockbox on a regular basis. Members can then take money out on loan, to be repaid back at relatively low interest rates, typically over the course of one to three months. There may be multiple groups within one community. According to one bank interviewed for this assessment, while savings groups are considered outside of the formal financial system, there are current regulatory efforts to integrate them in the formal system. As of 2020,

less than one in six farmers had a bank account; a stakeholder interviewed for this assessment expressed that even if they had one, most farmers do not use it.

Savings groups have acted as an avenue for introducing digital and digital finance solutions.

PREMIER's May 2023 financial access report revealed that women producers consider savings groups to be the most important financial service that they use. They cite the groups as having helped them learn how to save, accumulate funds, gain interest, and access short-term credit. Anecdotally, the emergence of savings groups has led many members to report substantial increases in production and increased engagement in the market. Additionally, the emergence of the groups has led to an increase in opening of mobile money accounts. Ophavela is the largest savings group promoter in Mozambique, with over 175,000 members, 59 percent of whom are women. The group has links to many large input suppliers, but no current known links to loan facilities.

Public sector considerations

Requirements for opening mobile and bank accounts are overly burdensome for farmers and they are generally unbanked. According to three key informants, there is excessive bureaucracy for opening mobile accounts with the Central Bank of Mozambique requiring numerous formal documents. Considering SHFs rarely access public services, such requirements act as major barriers to registering new SIM cards and/or opening bank accounts. A law passed in November 2022 attempts to ease the opening of banking accounts, particularly for rural residents, though its efficacy has yet to be determined.⁹³ At the same time, an April 2023 law puts larger requirements on citizens to register a mobile account--such as biometric data and providing identification documents--thus putting up additional potential barriers to digital access.⁹⁴ According to 2020 data from MADER, about one in six SHFs has a bank account.

Infrastructure-related issues of coverage, quality, and electricity hamper access to and use of digital services. According to interviews, infrastructure-related factors such as limited mobile network coverage (nine respondents), low quality of mobile networks (six), and lack of electricity (three) were critical barriers for uptake of digital services. As one moves from urban to rural areas, mobile coverage drops precipitously. When coverage exists, respondents complained of frequent oscillations in quality. Concerningly, lack of access to electricity (less than five percent of rural residents had access in 2020) nearly precludes the ability to own a phone since users must travel variable distances to simply charge a device. According to one interviewee, the telecommunications regulator INCM declared in February 2023 that network operators would be forced to share network infrastructure to increase coverage, however this never happened. According to an interviewee from a large NGO, "prior to implementing digital initiatives, Mozambique must expand physical infrastructure coverage, particularly to rural areas."

Cybersecurity is a real threat in Mozambique yet few practical actions have been taken to address it. According to stakeholders knowledgeable about the sector, cyberattacks are common in Mozambique. While legislation exists to protect consumers against cyberattacks -- and a recent law making obtaining a SIM card registration more difficult was instituted due in part to allegations of massive cyber fraud⁹⁵ -- stakeholders indicated that there is generally no enforcement of the laws and regulations. One key informant felt that legislation needed updating and there was a general lack of technical capacity at the government level to do forensic analysis of cybercrime. A local university indicated it was currently developing a response center for cyber incidents to effectively monitor and develop preventive measures. According to two mobile money operators, low levels of

⁹³ AMB. *Bank Accounts Adopt New Legal Regime*. Online: <https://amb.co.mz/en/contas-bancarias-adotam-novo-regime-juridico/>

⁹⁴ Club of Mozambique. 2023. *Biometric registration of SIM cards and other changes on their way | Mozambique*. Online at: <https://clubofmozambique.com/news/biometric-registration-of-sim-cards-and-other-changes-on-their-way-mozambique-236230/>

⁹⁵ Biometric Update. 2023. *Biometric SIM registration soon in Mozambique, Ghana orders block of unlinked lines*. Online at: <https://www.biometricupdate.com/202304/biometric-sim-registration-soon-in-mozambique-ghana-orders-block-of-unlinked-lines>

literacy among producers hamper security efforts and mobile money agents do not understand security risks associated with digital products.

Supply-side Services

This section goes into detail about the various supply-side factors and considerations affecting digital agriculture services and digital finance for agriculture. We begin with an overview of findings and then present select case studies in agriculture advisory services and market information, procurement and supply chain logistics, infrastructure, connectivity, and policy, and digital literacy and training. The section ends with a substantial mapping of digital finance in agriculture. Each case study was typically informed by between one and three key informant interviews, secondary research, and document reviews. Where possible, we lay out the scope of the case study as well as any impacts and challenges.

The assessment team found evidence of at least 67 digital agriculture solutions focused on a variety of services. Solutions varied substantially in their focus and overlapped considerably across market and basic agriculture advisory services, procurement and supply chain logistics, and digital and financial literacy and training. The assessment team found no or little evidence that the various solutions collaborated or were interoperable. Major sources included primary interviews conducted by the assessment team, the Digital Agri Hub database of Wageningen University,⁹⁶ a 2022 digital agriculture innovations report funded by the World Bank/CCARDESA,⁹⁷ and a 2019 digital ecosystem analysis conducted by the World Bank.⁹⁸ There are undoubtedly more solutions active in Mozambique than the assessment team was able to find.

Solutions focused for the most part on smartphone and laptop-based applications as opposed to SMS and USSD. More than half of services were developed as laptop or web-based platforms, oftentimes with an accompanying smartphone-based application. About a third of solutions included an SMS, USSD, or IVR component compatible with feature phones. Some smartphone applications had components which allowed feature phone users to call in to a support center for information. Considering the overwhelming proportion of farmers that use feature phones (or no phone at all), solutions did not necessarily target the largest segments of the population or were not aligned to the demand-side realities in which they worked.

The creation, rollout, and use of applications, products, and services nearly universally followed disconnected donor funding cycles. Most innovations were created with bilateral or multilateral donor funding and immediately discontinued once a donor project ended. Bilateral donors included the Americans, British, Germans, French, Dutch, Italians, Norwegians, Swedes, and Austrians, and multilaterals included the World Bank, IFC, UN (FAO, IFAD, etc.), and others. Much of the information the assessment team located was out of date and it was generally difficult to verify if a digital service was still active in Mozambique. Discussions with USAID project partners do not seem to take into account past USAID-funded projects and there appears to have been little continuity in digital programming between them. One USAID partner stated that there were “practically no digital solutions in the pipeline [but] if they exist they are unsustainable.” Several stakeholders (including USAID partners) admitted that digital solutions are generally not yet commercially viable, however USAID and other donors continue to push a commercial angle to solutions.

The scale of solutions varied widely and was, on average, relatively small. Solutions claimed to cover a wide number of stakeholders from a low of under 100 to as high as 40,000 (Agroponto app). The median number of beneficiaries typically cited was around two to three thousand. Most solutions were limited to one district or

⁹⁶ Digital Agri Hub. Online at: <https://digitalagrihub.org/>

⁹⁷ DIGITAL AGRICULTURE COUNTRY STUDY ANNEX: MOZAMBIQUE. Centre for Coordination of Agricultural Research and Development for Southern Africa. World Bank. 2022.

⁹⁸ The World Bank. 2019. *Mozambique Digital Economy Diagnostic Executive Summary Report*. Online at: <https://thedocs.worldbank.org/en/doc/833211594395622030-0090022020/original/MozambiqueDECA.pdf>

province, usually dictated by the programmatic scope of a project. The assessment team was unable to verify exact numbers of users and information was oftentimes several years old. Considering the sheer number of farmers in Mozambique (4.5 million), digital solutions are reaching very small numbers. According to a bank stakeholder interviewed for this assessment, “Digitization in Mozambique is at an embryonic stage.”

Advisory services and market information

Product and stakeholder(s)	Description
<p>Product: SIMA Implementer: MADER Donor: FAO, RESINA (USAID)</p>	<p>SIMA is a government run market information system software that collects information such as price of commodities, production statistics, and other market information at the producer level. FAO has been supporting the digitization of the platform which will eventually include a USSD/SMS, Facebook, and web component. MADER interviewees expressed the need to complete the digitization of SIMA as well as provide financial resources for data collection and dissemination of results to producers. RESINA, a USAID-funded Feed the Future (FTF) project just getting off the ground, expects to work with SIMA through direct work with MADER in making the system functional and increasing dissemination of key information to communities, though RESINA is only limited to two provinces (Nampula and Zambézia). Interviews with three stakeholders indicated that there was uncertainty as to which implementation avenue would prove successful in stimulating demand along the value chain to access information through digital channels such as SIMA and how to ensure sustainability of SIMA.</p>
<p>Product: Machamba (app) Implementer: Ologa Donor: formerly iDE Global, currently no support</p>	<p>Machamba is an application that disseminates key market and planting information to farmers. The application is designed for extensionists to use on smartphones and then translate to farmers. The application was created by Ologa, a private Mozambican technology start-up, and initially supported by funding from an NGO called iDE Global, though funding and development stopped in 2021. A stakeholder from the RESINA project indicated a desire to reactivate the Machamba application, however, in their opinion, the application appears to be duplicative with SIMA. Ologa, the creator of the application, indicated that it still requires substantial content input and remains to be fully tested in the field.</p>
<p>Product: Kuwaka (app) Implementer: CFB cooperative, Superior Politecnico de Manica (ISPM) Donor: UNIDO, GIZ</p>	<p>UNIDO, a UN agency operating in five provinces of Mozambique, worked with GIZ and a local cooperative supported by GIZ known as CFB. With the help of UNIDO, CFB trained producer farmers on quality standards and facilitated logistics such as transport to market. Starting last year, CFB started working with the company Step Innovation Africa (a Kenyan tech firm) to develop digital applications for technical assistance to facilitate the transmission of knowledge and technology, which were identified as being one of the biggest constraints for producers. In conjunction with Superior Politecnico de Manica (ISPM), a public institute for training and research, four modules on training have been developed for a smartphone based app used by producers. The app requires a smartphone and 3G access, but is otherwise free. Kuwaka expressed that in June 2023 they expected to scale up from 60 to 110 farmers and 5 extensionists. UNIDO admits major barriers in access to smartphones, connectivity, and digital and traditional literacy in rural areas. Lessons learned with Kuwaka according to stakeholders interviewed included using less demanding platforms and those that should be offline or not use smartphones.</p>
<p>Product: SMS-based system Implementer: United Nations University (UNU) Donor: UNU</p>	<p>UNU carried out a simple SMS-based agriculture price pilot in 2023. The program, which was piloted in 14 districts in Sofala and Zambezia provinces, consisted of sending five basic questions via SMS to producers to gather dynamic data on prices. Feedback on the pilot was mostly critical in nature. The cost of sending SMS messages was deemed extremely high at 1.5 MZN per message. Poor cell phone coverage meant many people did not receive messages. Not all producers answered all the questions. Many producers did not trust the system as well. UNU is re-evaluating the next phase and considering face-to-face meetings to socialize producers to the platform and to understand if and what price information would be of most use to them.</p>

Product and stakeholder(s)	Description
Product: unknown Implementer: Resilience Donor: Resilience	Resilience, a Dutch NGO, currently implements a project called IRIPO whereby a technological platform is used to connect farmers to tailored extension and advisory services. The geographic scope and timeline of the project was unknown at the time of writing of this report. ⁹⁹
Product: N'kalo (app) Implementer: Nitadae Donor: AFD Project: ACAMOZ	Funded by the Agence Française de Développement (AFD) and carried out by an organization called Nitadae, the ACAMOZ project uses the N'kalo system to exchange information with 60,000 cashew farmers registered in the ConnectCaju database. Utilizing SMS, radio, and other methods, the system disseminated market information such as price and planting advice. The organization is also developing a climate change land use forecasting tool as well. The assessment team was unable to collect lessons learned on the application, however, the cashew sector and the ConnectCaju database are generally understood to be well organized in Mozambique. ¹⁰⁰
Product: ConnectCaju Implementer: INCAJU, Technoserve Donor: USAID Project: Moza-Caju	The ConnectCaju smartphone based application helps ministry level track and register cashew farmers, cashew harvest and seedlings, for better extension services. Includes weather services. By 2018, the service had registered 100,000 cashew farmers in Mozambique. The assessment team was unable to verify if the platform was still functional.
Product: Drones Implementer: ThirdEye Mozambique Donor: USAID, SIDA, Dutch government	In the past three years, ThirdEyeMozambique has trained local operators to fly drones to provide information services to 3,500 farmers over 1,600 hectares. Drones are used for mapping and subsequent technical advice. Drone cameras process captured data on a computer, and upload maps to a tablet for subsequent crop condition advice that can be given to a farmer. Tablets and/or smartphones and ability to use them and connect to the Internet are required. The drones utilize low-cost, high resolution flying sensors at a height of 100 meters and take overlapping images to cover hundreds of hectares. The company also provides access to drones and tractors. ¹⁰¹
Various other	Additional solutions included: SmartFarmer by Riskflow DBS, SEGIA by Iniciativa para Democracia e Cidadania (IDC), ConnectedFarmer/Evuna by Vodacom/Mezzanine, ¹⁰² Akoko Market by Agro Innova Company Limited, Kuza One by IDH Mozambique, ¹⁰³ KRES by the KRES Network, Digital Grow by Fondation Ondjyla, IMPI by Agrimotion, ¹⁰⁴ the Global Farmers Connect platform, ¹⁰⁵ the Sharing Knowledge Agrifood Network from INOVISA, SkuduExact ¹⁰⁶ from Skudu, the Chameleon soil and water sensor from Vodafone/Mezzanine and CSIRO Australia, and AfricaFertilizer by the IFDC. ¹⁰⁷ These solutions were listed on the Digital Agri Hub ¹⁰⁸ dashboard or in the World Bank

⁹⁹ Resilience. *IRIPO*. Online at: <https://resiliencebv.com/projects/iripo-tailored-extension-services-to-smallholder-farmers-in-mozambique/>

¹⁰⁰ Nitidae landscapes and value chains. *Actions in progress*. Online at: <https://www.nitidae.org/en/nos-actions?pays%5B%5D=moz>

¹⁰¹ Third Eye Water. Online at: <https://www.thirdeyewater.com/>

¹⁰² Mezzanine. *Connected Farmer*. Online at: <https://mezzanineware.com/digital-productivity-technology/technology-solutions-for-agribusiness/smart-farming/>

¹⁰³ Kuza. Online at: <https://www.kuza.one/>

¹⁰⁴ Agrimotion. Online at: <http://www.agrimotion.net/>

¹⁰⁵ GLOBAL FARMERS CONNECT. *PROVIDING GLOBAL MARKETS FOR FARMERS*. Online at : <https://express.adobe.com/page/WgldqbEjBXI9x/>

¹⁰⁶ Skudu. Online at: <https://www.skudu.co.za/>

¹⁰⁷ Africa Fertilizer. Online at: <https://africafertilizer.org/#/en>

¹⁰⁸ Digital Agri Hub. Online at: <https://digitalagrihub.org/>

Product and stakeholder(s)	Description
	CCARDESA 2022 report ¹⁰⁹ but the assessment team was unable to verify their status in Mozambique.

Procurement assistance and supply chain logistics

Product and stakeholder(s)	Description
Product: Various Implementer: DAI, Green Fingers Mobile, Appload, others Donor: FTF Inova (USAID)	<p>The USAID-funded Feed the Future Inova project funded several ICT solutions to improve agribusiness between 2017 and 2022. Among these were working with a multinational mobile operator called Green Fingers Mobile¹¹⁰ to implement a SaaS based platform for supply management and inventory, a local technology logistics startup called Appload¹¹¹ on fleet management for large scale farm operations, and supply chain management with a consortium of local large agribusinesses companies such as Bayer, Olam, BAGC, and others. According to one local NGO, Bayer established a WhatsApp group with 500 producers; when a member of the group had a pest issue, they took a picture and sent it to the group to crowdsource solutions. Such a solution generated faster dissemination of knowledge than phone calls, and members were also able to communicate with SMS if there was no Internet, yet, the solution required a smartphone. Generally, the solutions were found to be priced too high or did not reach large numbers of beneficiaries, although Appload was selected for involvement in a European incubator in mid-2022.¹¹² The assessment team could find no information on the solutions beyond the end of the project in mid-2022.</p>
Product: Online ordering platform Implementer: AQI, TECAP Donor: unknown	<p>AQI, a large input supplier, has begun to use an online ordering and stock forecasting system¹¹³ as has a company called TECAP. Through the system, agrodealers can order inputs online and receive a realistic window for delivery of products. The new system allows agrodealers to better forecast their inventory and stock, provide more realistic delivery times for producers, and reduces the need for AQI and other large input shops to extend inputs on credit to agrodealers. Agrodealers can order stock when they need it and can even see the most in demand inputs in other provinces. As recently as 2020, the FTF Inova Rota Certa project attempted to work with ICT-Enabled Inventory and Digital Payment Solutions for Agribusinesses but deemed the work not worthy of investment for agribusinesses.</p>
Product: Agroponto (app) Implementer: Agro-Negócio para o Desenvolvimento de Moçambique (ADM) Donor: Nippon Biodiesel Fuel Co. (NBF); WFP	<p>Agro-Negócio para o Desenvolvimento de Moçambique, Limitada. (ADM) is a 30-person company based in Mozambique serving 40,000 producers and agribusinesses in three provinces. Their app is called AGROPONTO, developed by NBF as part of a Japanese-led public-private working group for innovation in Africa. It is a smartphone based app. The app matches buyers and sellers of agricultural products, equipment, and materials. The app was used for the WFP Virtual Farmers Market project (2019-2023) as recently as June 2022 when 140 lead farmers were trained to use it. The app has been around since March 2022 and the initial first customers were farmer group leaders, extension workers, local NGOs, and buyers. The app is in Portuguese, however a third-party converted it into one local language for one province in the north of Mozambique. ADM indicates that they've struggled to build a profitable business model for the app. They charge fees for a transaction, including the use of warehousing and transport, and have dabbled in microfinance services as well. ADM indicated that electricity and Internet connectivity are also challenges to</p>

¹⁰⁹ DIGITAL AGRICULTURE COUNTRY STUDY ANNEX: MOZAMBIQUE. Centre for Coordination of Agricultural Research and Development for Southern Africa. World Bank. 2022.

¹¹⁰ GFM. Online at: <https://greenfingersmobile.com/>

¹¹¹ Appload. Online at: <https://appload.co.mz/en/>

¹¹² Club of Mozambique. 2022. *Mozambique's Appload among 20 startups selected for Norrsken Impact Accelerator*. Online at: <https://clubofmozambique.com/news/mozambiques-appload-among-20-startups-selected-for-norrsken-impact-accelerator-218438/>

¹¹³ AQI. Online at: <https://www.aqi.co.mz/>

Product and stakeholder(s)	Description
	<p>overcome, though they said they're looking into Starlink and solar to solve these issues. They are currently working on integrating mobile money operability. It's a SaaS platform and can be easily adapted/interoperable to other softwares. ADM said that farmers are open to digital solutions, and that youth can aid in facilitating integration. They have had difficulties in the north given low literacy and low uptake of smartphones; to get around this, their targets have shifted to the group unit as opposed to the individual and have distributed smartphones. Cost is a major barrier, but they are designing the service as a freemium model with free basic services. The app can still be used without a smartphone whereby a customer can call into a call center to obtain the information needed.</p>
<p>Product: FARM (app) Implementer: Unknown Donor: GIZ</p>	<p>GIZ has developed an application called FARM for companies working in the ag sector. The app creates a database of producers for a company to showcase when accessing loans from banks. To date, GIZ's use of this application improved producer information among 2,000 rice farmers, 2,000 soy farmers, 14,000 cotton farmers, and 23,000 farmers total in Manica province. In addition to producer management, the app can do stock management, purchase of products in the field, production promotion credit management, training management (number of participation in training sessions), production of surveys, and production tracking from the field to the factory. GIZ piloted the app with three major companies: Highest, Eca, and Novos Horizontes; in its new iteration (2021-2024), GIZ is working with 5 companies with a target of 8 by 2024. The app currently runs on a web browser and through a smartphone app.</p>
<p>Product: Traceability software Implementer: Competitive Cashew Initiative Donor: GIZ Project: ComCashew</p>	<p>The GIZ project Competitive Cashew initiative (ComCashew) is part of the GIZ program on the "Broad-scale Promotion of Agricultural Value Chains in Africa". The project implements a traceability software that tracks high-volume transactions like farmer registration, prepayment, purchase, logistics and payments. These are recorded and synchronized in the field in real time via smartphone and supported by a laptop-based application.</p>
<p>Various other</p>	<p>Additional digital solutions in the area of procurement, traceability, and supply chain logistics included: Smartware and Root Trace (two applications by the company CROPIN),¹¹⁴ Hello Tractor,¹¹⁵ eProd of eProd Solutions, Inc.,¹¹⁶ and the FBSInnova mobile application.¹¹⁷ Another solution straddling supply chain logistics, traceability, and land use was Data4Moz,¹¹⁸ a data analytics company focusing on natural resources management with additional solutions in value chain mapping and digital farmer profile building. These solutions were listed on the Digital Agri Hub¹¹⁹ dashboard or in the World Bank CCARDESA 2022 report but the assessment team was unable to verify their status in Mozambique.</p>

¹¹⁴ Cropin. Online t: <https://www.cropin.com/intelligent-agriculture-cloud/cropin-apps/farm-management-solution>

¹¹⁵ Global Development Policy Center. 'The Uber-meets-Salesforce for Tractors': Using Blockchain Technology to Increase Access to Machinery for Farmers in Africa. Online at: <https://www.bu.edu/gdp/2022/08/04/the-uber-meets-salesforce-for-tractors-using-blockchain-technology-to-increase-access-to-machinery-for-farmers-in-africa/>

¹¹⁶ Eprod. Online at: <https://www.eprod-solutions.com/>

¹¹⁷ FBSInnova. Online: <https://www.fbsinnova.com/#/>

¹¹⁸ Data4Moz. Online at: <https://data4moz.com/>

¹¹⁹ Digital Agri Hub. Online at: <https://digitalagrihub.org/>

Policy-level

Product and stakeholder(s)	Description
Product: N/A Implementer: Various Donor: World Bank Project: World Bank Digital Acceleration Project:	<p>In mid-2022, the World Bank approved a five-year \$200 million project for Mozambique that focuses first and foremost on expanding access to mobile and broadband services for two million Mozambicans.¹²⁰ Further, it works on broad-based reforms to the telecoms sector to encourage private sector competition to expand coverage and drive down price, includes a framework for supporting digital skills programs (including equipping secondary students with laptops and upskilling teachers), and investments in core digital infrastructure to modernize government services.^{121,122} While the project is relatively new and large, no stakeholders interviewed for this assessment -- including World Bank officials -- commented on the program.</p>
Product: N/A Implementer: Public sector Donor: GIZ Project: PROECOM	<p>Since 2012 and extending through 2024, GIZ has been implementing the PROECOM program¹²³ with three distinct foci related to digital: private sector development, financial inclusion of communities, and improving the financing environment for agriculture. GIZ partners with the EU in this project. GIZ is working at the regulatory level with the Central Bank to implement the National Strategy on Financial Inclusion and with individual banks to expand financial services to rural areas.</p>
Product: CIFAM Implementer: MADER Donor: GIZ	<p>GIZ, in conjunction with MADER, implements a multisectoral coordination and dialogue platform for agricultural financing called CIFAM with working groups on guaranteeing collateral, tax incentives and banking policies, digitalization of the agricultural ecosystem, and formalization services for businesses. For the pillar on digitalization, GIZ is mapping stakeholders in the digital agricultural ecosystem, selecting key value chains, and developing sustainable digital models along with key actors identified in the ecosystem. Participants in these working groups are MADER through DNPAC, GIZ, MIC, the Central Bank, the Mozambican Bank Association, and CTA/FENAGRI. The platform was launched in April 2023 and has four working groups: Working Group 1 - Guarantees collateral, Working Group 2 - Tax Incentives and Banking Policies, Working Group 3 - Digitalization of the Ecosystem Agricultural, and Working Group 4 - Formalization and Business Services.</p>

¹²⁰ The World Bank. 2022. *Moving Mozambique Toward a Digital Future*. Online at: <https://blogs.worldbank.org/digital-development/moving-mozambique-toward-digital-future>

¹²¹ The World Bank. 2022. *Moving Mozambique Toward a Digital Future*. Online at: <https://blogs.worldbank.org/digital-development/moving-mozambique-toward-digital-future#:~:text=The%20project%20is%20a%20collaboration,and%20services%20at%20their%20fingertips%2C>

¹²² The World Bank. 2021. Torgusson, Casey, „ *Concept Project Information Document (PID) - Mozambique Digital Acceleration Project - PI 76459 (English)*. Online at: <https://policycommons.net/artifacts/1850820/concept-project-information-document-pid/2597767/>

¹²³ GIZ. Online at: <https://www.giz.de/en/worldwide/104687.html>

Digital and financial literacy and training

Product and stakeholder(s)	Description
<p>Product: Digital literacy training Implementer: CIUEM Donor: Italian government</p>	<p>The Computer Center of Eduardo Mondlane University (CIUEM) currently manages the .mz internet domain and all university domains in Mozambique. The center focuses on promotion of ICTs and digital teaching and, in 1999, launched a series of telecenters that allow communities greater access to radio. The center also is responsible for launching School Net 124 and other initiatives that have brought the internet to schools. They currently offer free summer school courses in ICT and training and workshops for communities on ICT.¹²⁵ With funding from the Italian Government, CIUEM has a physical space for the incubation of innovative ideas and businesses. The incubator will start its initial activities in September 2023 under three support pillars: (1) creativity: taking innovation products to entrepreneurship, (2) Establishing links between entrepreneurs and different academic bodies, (3) Business development: training in areas relevant to business management, pre-incubation. The center will host an annual 3-day hackathon for programmers to come up with solutions to problems posed by clients. CIUEM brainstormed several areas in which its services could be of use for digital agriculture including development of digital platforms to track price and other market variables, using artificial intelligence to improve agricultural efficiency and assess the risk of providing credit, help ensure compliance in digital services based on the electronic transaction law, act as a hub to test solutions, and develop course for extensionists.</p>
<p>Product: N/A Implementer: MUVA Donor: GIZ; formerly UKAID and OPM</p>	<p>MUVA: A small Mozambican association, MUVA, has offered digital and ICT related support directly to women since 2015. Originally funded by UKAID and OPM, the association is now funded mostly by GIZ and, as of 2022, has offered digital literacy related support to over 1,500 women in 17 districts of Mozambique.¹²⁶</p>
<p>Product: Tablet Comunitaria Implementer: Tablet Comunitaria Donor: PSI, various public institutions</p>	<p>Tablet Comunitaria is a mobile technology center, or a “school on wheels” - a mobile trailer that can be attached to a car or other moving vehicle. It consists of six large LCD screens and broadcasts lessons in a wide range of topics, including digital-related topics, to mostly secondary students. According to its website, since 2015 the mobile trailer has reached over one million students in more than 90 communities in Mozambique. The mobile school is supported by a number of public institutions and donors such as PSI Mozambique.¹²⁷</p>
<p>Product: Viamo 3-2-1 Implementer: FHI360, Viamo, others Donor: USAID Project: Alcançar</p>	<p>Though it is health focused, the five-year USAID-funded Alcançar project (through 2024), implemented by an FHI 360-led consortium of eight partners, utilized an innovative digital health worker training system to upskill health workers in key areas of work.¹²⁸ The partner is mobile platform company Viamo, whose Viamo 3-2-1 platform pushes information to simple phones and those not connected to the Internet all across sub-Saharan Africa, via SMS and IVR.¹²⁹ Case studies of the program found substantial pre and post-test increases in knowledge among community health workers who accessed the training devices using IVR.¹³⁰ Case studies on Viamo</p>

¹²⁴ SchoolNetAfrica. 2020. Mozambique. Online at: <https://schoolnetfrica.net/1128.0.html>

¹²⁵ Centro de Informática da Universidade Eduardo Mondlane (CIUEM). 2019. Espaço de Inovação. Online at: <https://www.ciuem.mz/espaco-de-inovacao/>

¹²⁶ Muva. Online at: <https://muvamoz.org/en/>

¹²⁷ Tablet Comunitario. Online at: <https://tabletcomunitario.org/mz/>

¹²⁸ Viamo and FHI360. In rural Mozambique, digital training is improving maternal and child healthcare literacy. Online at: <https://viamo.io/global-health/alcançar-mozambique-maternal-child-healthcare/>

¹²⁹ Viamo. Online at: <https://viamo.io/services/viamo-platform/>

¹³⁰ FHI360. Remote Training Improves Knowledge of Key Maternal, Newborn, and Child Health Services in Nampula Province, Mozambique. Online at: <https://www.fhi360.org/sites/default/files/media/documents/resource-alcançar-success-story-remote-training.pdf>

Product and stakeholder(s)	Description
	and its Viamo 3-2-1 platform demonstrate its successful use in an agricultural context in countries such as Niger, Tanzania, and Nepal.
Product: N/A Implementer: Unknown Donor: GIZ Project: ProEcon	According to interviews with GIZ, the agency has funded digital literacy campaigns on how to use a bank account, resulting in the opening of 140,000 bank accounts and 29,000 mobile accounts. It primarily uses radio programs for financial and digital education. The assessment team was unable to find information on the project beyond the statistics above as given by the interview respondent.
Product: Mobile libraries (on hard drives) Implementer: Ologa Donor: Unknown	A small tech start-up, Ologa, currently implements a program whereby small, Raspberry-Pi like hard drives are distributed to agrarian institutes. The hard drive contains a library of over 500 videos and books on agriculture, digital, and financial literacy topics. Students at the institutes connect the devices to laptops or phones, access the Internet through a partnership with Starlink, and consume the material. According to Ologa, the idea is that youth take the lessons learned in agriculture, digital, and finance back to their communities and share it with producers, thus improving overall digital and financial literacy in those areas while benefiting young people. At the moment, Ologa is only piloting the work in Nhamatanda district.
Product: Internet access Implementer: Afamba Donor: Starlink	Through a partnership between Afamba, a company specializing in regulatory and policy navigation for space-related technologies, Starlink is offering Internet access services in several agrarian institutes throughout the country. The assessment team could not find specific information on the scope and scale of the project, however it confirms that Starlink is operational and being utilized in the agriculture sector in an educational context.
Product: N/A Implementer: Bluetown, GAPI Donor: USAID Project: Women Connect Challenge	Between 2018 and 2021, USAID's Women Connect Challenge funded a project carried out by Bluetown, an Internet service provider focused on connecting rural hard to reach populations, and GAPI, a quasi public-private investment vehicle, to help women access the digital marketplace. The program implemented a lease-to-own phone system for approximately 100 women and set up a no-cost dependable Internet network locally where women could access videos on entrepreneurship and other topics. ¹³¹ When the project ended in 2021, all funding ceased for the work.
Product: Containerized business incubators Implementer: Incubox Mozambique Donor: EU, GAPI	According to Ologa, a similar version of the GAPI-Bluetown-USAID work continued after the end of the project in 2021. This work is funded by the EU and implemented by a company called Incubox Mozambique. The project takes place in Niassa province and provides 90 women with containerized business incubators to assist them in starting their own businesses. The work is expected to last through 2023 with unclear funding and sustainability plans afterward.
Various other	The team also found information on a microlearning tool (complete with projector and tablet) for agricultural extensionists created and marketed by IDH in partnership with Kuza as part of the Mozambique Climate resilience Project. The last known information about this solution was from February 2020. ¹³²

Digital Finance

In this section we explore and map the nexus of digital finance and agriculture. The section begins with overall findings on digital finance in agriculture and subsequently lays out several case studies. We strongly recommend

¹³¹ Digital Frontiers. 2021. *GAPI-SI and Bluetown Factsheet*. Online at: <https://www.digitalfrontiersdai.com/resources/gapi-si-and-bluetown-factsheet/>

¹³² IDH. 2020. *IDH Launches Digital Microlearning Tool for Climate Resilience in Agriculture in Mozambique*. Online at: <https://www.idhsustainabletrade.com/news/idh-launches-digital-microlearning-tool-for-climate-resilience-in-agriculture-in-mozambique/>

reading the USAID PREMIER 2023 Financial Sector Mapping report¹³³ as a supplement to this section. Findings presented here draw heavily from that report in addition to primary interviews and additional secondary research.

The assessment team found 28 separate digital agriculture financial services or interventions taking place in Mozambique. These ranged from mobile money solutions (at least seven) and insurance (one currently operating) to e-vouchers (two), revolving credit, and loans and grants programs from a variety of sources including donors and banks. As with digital agriculture services in the previous section, the list is undoubtedly not exhaustive; many more solutions exist or are currently being developed. The above number is inclusive of agriculture sector financial products offered by banks (at least eight) but not microfinance institutions (several).

Digital agriculture financial services are offered from a variety of public, private, and donor sources. While banks allocate an average of less than three percent of their investment portfolios to agriculture, at least eight traditional Mozambican banks are currently lending to the agriculture sector. There are countless microbanks at varying levels of formality and legal registration throughout the country that cater to rural populations. GAPI is actively engaged in the financing of agricultural development. MADER implements a major agricultural input loan and grant program. On the donor side, several large bilateral and multinational donors offer loan guarantees and grant programs. Though it does not focus specifically on digital, the World Bank in 2021 approved a ten-year \$150 million grant to improve economic outcomes for small fisheries and farmers in the country.¹³⁴

The enabling environment for digital finance is generally burdensome and weak. Several stakeholders interviewed spoke of the conflict of interest between the Central Bank and private financial institutions such as banks and microbanks in setting policy and requirements for formalization and loan approvals. The Central Bank's prime lending rate of around 25 percent is exorbitantly high for rural borrowers. Requirements for collateral are hampered by the fact that the law bars citizens from using land as collateral. The Central Bank imposes a high bar to register a bank account given concerns about money laundering; all segments of the population are treated equally in this respect even though smallholder farmers can't produce the same documentation as larger stakeholders. According to one stakeholder familiar with ICT policy, "technology advances faster than regulation" in Mozambique. According to interviews, the ICT regulator, INTIC, was created in 2018 and does not yet have the capacity to update regulations. In addition there is confusion among the private sector as to which public institution to work with on regulatory affairs, given overlapping roles between INTIC and the former regulator INCM. GIZ currently organizes a regular policy-level dialogue platform to improve financial access in Mozambique though it is relatively new as of April 2023; a second dialogue platform known as AgriRed convenes donors on agriculture finance regularly. On a positive note, testing of a USSD component for a state payment system is underway as part of the National Payment System vision 2022-2027. According to bank stakeholders interviewed, such actions should boost the use of mobile financial services in the country.

Mobile money is rapidly expanding in Mozambique in the agriculture sector but major constraints remain. Mobile money services, introduced in 2011, have accelerated the population's access to formal financial services. PREMIER's study indicates a steady increase over time in the use of mobile money in Mozambique, particularly with M-Pesa and e-Mola for agriculture producers. According to several stakeholders interviewed, mobile money operators are interested in expanding into the savings group sector with one mobile operator currently in the process of creating a savings group service where money can be directly disbursed from a mobile money operator to a mobile money wallet instead of going through a bank first. However, major constraints to the success and scale of mobile money remain. For one, the network of mobile money agents is not large enough and,

¹³³ USAID Feed the Future Promoting Innovative and Resilient Agriculture Market Systems (FTF Premier). Financial Ecosystem Mapping. May 2023.

¹³⁴ The World Bank. 2021. *Mozambique: World Bank Approves \$150 Million to Improve Incomes and Resilience in the Rural Economy*. Online at: <https://www.worldbank.org/en/news/press-release/2021/06/09/mozambique-world-bank-approves-150-million-to-improve-incomes-and-resilience-in-the-rural-economy>

with the high dispersion of farmers in rural areas, does not adequately cover SHFs. Because each mobile money operator has its own agent network, GIZ and other donors have recently floated the idea of a shared agent network to facilitate expansion of mobile money. Further, the PREMIER mapping reports that “agrodealers are increasingly serving as agents for mobile money providers, e-vouchers, payment systems and have a good knowledge of these services.”

Interoperability of mobile wallets and banks exists in law, but in practice it does not happen for a variety of reasons. In 2017, a law was passed requiring interoperability between mobile wallets and banks. To comply with the law, recently the Mozambican association of banks (SIMO) implemented a system of general payment interoperability solutions in Mozambique between mobile wallets and banks which allows financial transfer transactions, cardless withdrawals, and POS purchases. However, according to the Association of Mozambican Banks, while banks can transfer money to and between mobile wallets, the interoperability solution is not yet being used at banks or on banks’ mobile banking channels even though there exist bilateral agreements between banks and electronic money institutions. Further, according to interviews, interoperability has led to increased cost to the customer as the main sectoral players (banks, SIMO and mobile money operators) try to maximize their gains. Finally, interoperability of mobile money is complicated by the fact that there is no interoperability in the use of mobile agents.

Banks perceive the agriculture sector as high risk yet many still have (small) agriculture lending portfolios. Collateral remains one of the largest impediments to traditional financing of SHFs. Farmers are unable to use land as collateral as it is banned by law. Banks that have investment products for agriculture instead require a formal agreement, such as a contract, between a farmer and some piece of the value chain, though SHFs may not always have such agreements. Farmers generally lack identification cards or documentation and cannot present a history of financial transactions. Banks perceive agriculture as high risk due to shocks such as weather and pests, with one indicating that “insurance services are non-existent.” Stakeholders in the insurance sector confirmed that “there is no culture of insurance” in Mozambique, and the Central Bank’s duty of 5 percent is comparably high. The Insurance Law was last updated in 2001. Interview data from banks indicated they also do not trust data collected by MADER on farm-level production. All in all, banks cite shocks and a lack of clarity on data as the major barriers to lending in agriculture. At the same time, the assessment team learned of two organizations working on digital asset registries, which, along with the use of e-vouchers could help to establish a digital financial history paper trail for farmers. As of May 2023, banks with current lending portfolios in the ag sector include: Access Bank (in partnership with Txuna M-Pesa), ABSA (which has a recent \$16.5m guarantee with USAID), BCI, FNB, Millennium BIM, Moza, Standard, and Societe Generale. Microfinance and SME Lenders include AfricaWorks (in partnership with GIZ), GAPI, Microbanco Futuro, and MyBucks.

Stakeholders up and down the agriculture value chain participate in digital finance in very different ways. At the top, large actors such as large producers, processors, and exporters access loans from banks. These loans, without exception, are oftentimes the only loans that banks give out in agricultural lending. Further down the chain, large scale commercial input suppliers, who access finance from large financial institutions, generally perceive high risk in lending to smaller agrodealers who lack capacity to maintain consistent and sufficient stock levels. These small agrodealers prefer arrangements with large input suppliers (two of whom - AQI and TECAP - have started online forecasting systems), and generally lack the knowledge about how to apply for bank loans. According to the report, there is a desire for small agrodealers to lend to producers but doing so is perceived as highly risky mostly due to limited information about the producers themselves. Small emerging commercial farmers, whose operations are larger than SHFs, oftentimes act as lenders of inputs to and buyers of produce of SHFs. These small-medium sized farmers use mobile money, access bank loans, and sometimes act as agents for payment services and e-vouchers. Aggregators and processors, the report found, were often cash strapped and very reluctant to take loans from banks with high interest rates. Both groups work closely with producers and both were identified as having an acute need for credit. Larger processors and producers, particularly those in closed value chains, offer credit to producers in their networks, but this is typically done based on years of trust.

Similarly, agrodealers will have lending relationships based on trust. According to PREMIER's financial ecosystem mapping, "Small producers are unlikely to receive finance from banks, except for through creative partnerships such as M-Pesa Txuna (ACCESS), savings groups (several banks piloting accounts) and managed credit facilities to MFIs (Moza)." Informal savings groups remain the main source of finance and credit for most SHFs, especially women.

There are a few local financial sector actors large enough to make a systemic impact on the agriculture sector. Banks could play this role but typically only loan to large operations or for specific value chains and generally do not market their services to other value chain actors. Bank staff have low capacity in understanding the agriculture sector and banks generally agreed that interest rates were too high for ag-sector borrowers. GAPI plays an important quasi public-private sector role and, particularly with recent funding from USAID, has relatively large investment potential. In the insurance sector, only Hollard has a dedicated agriculture insurance department offering weather insurance index to agribusiness and producers. MADER's flagship agricultural project SUSTENTA is currently providing partial and in-kind loans and grants to SMEs in agriculture. Savings groups have a major presence throughout the country with hundreds of thousands of registered members.

Women have been largely excluded from the digital financial system. According to a study conducted by M-Pesa, women are relatively excluded from participating in the mobile money financial ecosystem due to a lack of cash on hand. The study found that women's savings go first and foremost to household consumption with little left over for mobile money transactions. The same study indicated that mobile money fees act as a further barrier to integrate women into the system. The study recommended that future solutions to the problem of inclusion must combine both training in financial literacy and mobile money to be ultimately successful, particularly among women. A second mobile operator confirmed that women are the most excluded population in terms of owning mobile wallets while a third stakeholder, an NGO, indicated that it is mostly men with access to mobile phones. The same stakeholder said that husbands and fathers often forbid women from owning mobile phones. Nevertheless, women play an important role in post-harvest and estimates from two stakeholders put 60-80 percent of savings group members as women.

Women can and are benefiting from greater access to mobile money. According to PREMIER's 2023 financial ecosystem mapping, women's needs for finance are highest during planting, seeding, weeding and harvesting, which vary by crop planted.¹³⁵ The study indicated that access to savings is the most important need to enable them to save money in a location away from the household where it is subject to reduced control and theft. Credit is the second most important service for women. Those interviewed for the PREMIER study and for this assessment indicated that women oftentimes receive loans through savings groups. Women indicated having knowledge about mobile money and understood the benefits such as reduced travel times to withdraw cash, and the PREMIER study indicated that women in savings groups who have access to M-Pesa or e-Mola agents are seeking out those services.

Projects targeting access to finance for youth face large behavior change barriers. With respect to youth, almost half of all SHF households (47 percent) are headed by those under the age of 40.¹³⁶ According to PREMIER, for these young people, savings was considered most important to ensure the security of money. A recent World Bank study - the Moz Agriculture and Natural Resources Landscape Management Project - found that young farmers lacked both technical skills but also the vision to see farming as a true business opportunity. Without such vision and training to see it, youth may not utilize the financial services available for them in the sector.¹³⁷ Currently there are several projects focusing specifically on young farmers: GIZ's Novos Horizontes,

¹³⁵ FTF PREMIER. Financial Ecosystem Mapping. May 2023.

¹³⁶ FTF PREMIER. Financial Ecosystem Mapping. May 2023.

¹³⁷ The World Bank. 2023. *Moz Agriculture and Natural Resources Landscape Management Project (P149620)*. Online at: <http://documents1.worldbank.org/curated/en/099062323170518573/pdf/P149620048b8fb0e50b41100be2ddaf3322.pdf>

MADER SUSTENTA's "PACE Jovem," and a second GIZ-sponsored loan project through an NGO called AfricaWorks.¹³⁸ According to PREMIER, market actors offering loans such as large input suppliers and off-takers are less likely to finance youth since youth have a reputation of not knowing about agriculture and not knowing how to enter the market.

¹³⁸ FTF PREMIER. Financial Ecosystem Mapping. May 2023.

Table 13: Programs supporting financial services for agriculture

Programs Supporting Financial Services for Agriculture		
Direct funding (equity or debt to large agribusinesses and PPP)	AfDB IFC USAID/DFC	Promote value chain development through anchor companies or agro-industrial hubs
Direct credit facilities to agribusinesses and PACEs	FAR (SUSTENTA Program) Fundo Catalitico	Government entities providing subsidized credit lines to agribusinesses and PACEs
Credit Lines to commercial banks or MFIs	AfDB IFAD KfW World Bank (upcoming <i>Mais Oportunidades</i>)	Encourage financial institutions to increase lending to the agricultural sector. sometimes at below-market rates
Guarantee Facilities	USAID/DFC SIDA World Bank (SUSTENTNA Landscape project) AFD	Reduce banks for lenders, some require reduction collateral
Equity In microbank	SDC	Microbanco Futuro in Nampula
Non-debt Investment facility for agriculture	FCDO	In development. Will seek to address the gap in alternative financing
Smart subsidies to reduce interest rate	FCDO	In development will seek to use smart subsidies to reduce the cost of debt on the other
Technical support to financial institutions	GIZ KfW (linked to credit lines) SIDA (through FSDMoc)	Ranges from developing agricultural lending products to strategic development to testing new channels
Support for development of agricultural insurance	IFC	At sector level (regulator) and with institutions and MADER/FNDS
Innovations/technology	SIDA (through FSDMoc)	E.g. Fintech Sandbox and grants for new initiatives
Savings groups promotion and linkages and financial education	GIZ IFAD USAID	Increase outreach, formalize groups, improve data, link to banks, mobile operators and agrodealers, financial/entrepreneurship education
Support to regulatory environment and financial Infrastructure	SIDA (through FSDMoc) IFC GIZ SDC (microbanks)	Various efforts looking at the regulations for banks, microbanks. equity funds. agent networks. Also, mobile asset registry. credit bureaus, data.
Studies/research for publication	World Bank GIZ SIDA (through FSDMoc)	A number of recent and relevant studies mapping services. assessing gender questions, analyzing challenges. looking at technology solutions
Promotion of sector dialogue (through Agreed, FABI, etc)	FDCO GIZ World Bank USAID	Sector information is reportedly a challenge and interviewed donors did not have a good overview of programming. Efforts to improve dialogue/better use resources.

Note: The above table is inserted as it appears in the PREMIER 2023 financial sector mapping report, inclusive of slight grammatical errors

Table 14: Products and Stakeholders

Product and stakeholder(s)	Description
<p>Product: digital app (name unknown) Implementer: Unknown Donor: GIZ</p>	<p>GIZ is currently developing a digital app to improve information within savings groups as part of its focus on financial inclusion in communities. The app will focus on digitizing operations and generating data on savings group members, which can then be used to access financing and insurance. The app is currently being piloted among 300 women in Zambezia province.</p>
<p>Product: e-voucher Implementer: FAO, GIZ, DIME, FNDS Donor: EU Project: Promove</p>	<p>FAO, through a EU-funded project called Promove (GIZ and World Bank partnering), implements an e-voucher program which provides subsidies of between 60 and 90 percent of agricultural input costs (seeds, fertilizers, etc.). According to interviews, 20,000 people have benefitted from the e-voucher system. Promove specifically works in the provinces of Nampula, Zambézia and Sofala. Initial registration requires taking biometric information with an offline app, which is then subsequently uploaded to the cloud with the internet and added to a database. Beneficiaries receive a physical card and then can visit an agro-dealer to buy inputs at a subsidized price. FAO noted that challenges include agro-dealers deceiving beneficiaries due to low levels of literacy, guaranteeing the quality of inputs, and the absence of physical networks for sale and distribution of inputs. According to FAO's measurement of longer-term outcomes, the e-voucher system has resulted in increased use of improved inputs and subsequent improved production. They also found that increased access to improved inputs through points of sale can increase demand for those inputs. Finally, the number of agro-dealers has increased in the area of influence due to the e-voucher system which has stimulated business growth. PREMIER profiled the FAO e-voucher in its 2023 financial ecosystem mapping report. According to interviews with groups of farmers, the e-voucher was cited as one of the most important sources of financing for small producers for inputs. The report also noted that FAO is currently investigating if SUSTENTA's loans and grants could be paid out through the vouchers which would "open the possibility to use this system more widely for other financial transactions with small producers."</p> <p>According to the World Bank, the e-voucher system implemented by FAO has proved to be promising and is believed to be the future solution for financing agriculture in Mozambique. It allows farmers to choose what input to buy, uses a network of local private services (agrodealers) and reduces the possibility of corruption that is seen in some government programs. Despite some of these gains, the pilots are small in nature, covering only small areas not reaching district, provincial, or national level. A 2019 impact evaluation of the e-voucher program showed that compared to those who did not receive the e-vouchers, recipient farmers had increased harvest areas, increased harvest production, increased incomes, and stronger relationships with agrodealers.¹³⁹</p>
<p>Product: Savings group and mobile money integration Implementer: Kukula Donor: GIZ</p>	<p>Kukula, a Mozambican NGO, has partnered with GIZ since 2014 to offer financial services to rural populations in Inhambane province. The NGO reaches 30,000 beneficiaries, with a goal of 20 percent using mobile wallets. In the end 20,000 registered with mobile wallets marking a major success of the project. A follow on project with GIZ through 2024 targets 8,000 beneficiaries and has achieved a mobile money wallet rate of 60 percent. Kukula cites factors of success as a robust communication and marketing strategy using radio soap operas, traditional radio, and face-to-face meetings with communities to spread information about the importance of financial services/technologies. Kukula is exploring partnerships with public sector entities and other donors to increase dissemination of information technologies more widely. Kukula works with all three major mobile money operators. Kukula helps start savings groups consisting of 30-40 members. While they admit there is little interest from savings group participants for mobile money since money is controlled by only a handful of people in the group and kept in a safe box, mobile wallet</p>

¹³⁹ FAO. 2021. *Trial, error, and success: Learning from 20 years of voucher interventions in Mozambique*. Online at: <https://www.fao.org/3/cb4829en/cb4829en.pdf>

Product and stakeholder(s)	Description
	operators are interested in expanding into the savings group area. Kukula is open to partnering with other organizations to expand access to finance, financial and digital literacy, and savings groups.
Product: Hivenetwork (online platform) Implementer: Hivenetwork, Mozambican Association for the Promotion of Modern Cooperativism (AMPCM) Donor: Norges Vel	<p>Hivenetwork has partnered with the Norwegian aid agency and the Mozambican Association for the Promotion of Modern Cooperativism (AMPCM) to create a platform that covers a range of services including coop or savings group management, including finances, a database of purchases and sales, and internal loan functions. Most importantly, the system allows for individual profiles of farmers, showing what each person has grown, sold, purchased, loans taken out, loans repaid, etc. This record also generates a financial statement and credit score which can help a farmer build a record that might enable them to access finance later on. The application works offline, but does require a smartphone.¹⁴⁰ According to a 2022 report by CCARDESA, Hivenetwork currently has about 3,000 active users.</p>
Product: M-Pesa (mobile money) Implementer: Vodacom Donor: N/A	<p>M-Pesa is a mobile wallet service that allows people to transact money, pay for services and bills, and access financing from banks (the typical payback period is 7-30 days and interest depends on the partner bank -- Mozabano or Access Bank). Owned by Vodacom, the mobile money wallet currently has 6,000,000 active subscribers who make at least one transaction per day. M-Pesa's model consists of recruiters, super-agents, and agents. Agents are typically local merchants, not full-time Vodacom employees, while super-agents work for Vodacom and provide liquidity to agents. Recruiters recruit agents to work in rural areas. As of 2023, M-Pesa had 54,000 agents-- which is growing at a rate of 10-15 percent per year, 30 percent of which operate in rural areas. Most agents are male and between 18-34 years old. According to interviews, M-Pesa faces many challenges in expanding and deepening services in rural areas including a lack of economic development, low cash circulation, lack of demand for services, lack of incentive for agents to work in rural areas, and absence of physical banks/ATMs which constrains the liquidity of its agents. Currently M-Pesa has no specific agriculture-focused services, however a strategy to expand into the sector was approved in March 2023 and remains dependent on funding to execute. Despite these challenges, there is evidence that Vodacom is interested in expanding its presence in rural areas: in 2023, the company installed 200 additional antenna relays in rural areas to expand its mobile network. Interviews indicated a marked interest in the agriculture sector, with the provinces of Zambézia, Cabo Delgado and Nampula as the most attractive for the company. Respondents also noted that a risk sharing mechanism would make it more attractive to expand into the sector.</p> <p>At the moment, M-Pesa also has a loan product called Txuna, in partnership with Access bank. The loan product is reaching small-medium and small producers, however the interest rates are relatively high (10-15 percent) and there is anecdotal evidence that borrowers are having trouble repaying loans.</p>
Product: mKesh (mobile money) Implementer: TmCel Donor: N/A	<p>Operated by Tmcel's Carteira Movel company since 2011, Mkesh left the market between 2016-2020 and returned in 2021. Market share is somewhere between 3 and 16 percent, conflicting estimates; this is even smaller in rural areas due to lack of infrastructure. mKesh currently has 3,600 agents, of which 80 percent are men, with an average annual growth rate of 10 percent. Like M-Pesa, customers can use mkesh to pay for services or bills. The service also historically included a savings group component, however the service was canceled by the Bank of Mozambique given the risky financial situation of the company. There are 67,000 mobile money subscribers, 14 percent of which make at least one transaction per month. Mkesh noted that agents generally don't have working capital to serve customers on an ongoing basis and a lack of network infrastructure means agents are rarely on site. Mkesh reports that 90 percent of its users utilize 4G, and ten percent use 3G; Tmcel also has a few new antennas capable of broadcasting 5G. Mkesh noted an interest in</p>

¹⁴⁰ Hive Online. Online at: <https://www.hivenetwork.online/>

Product and stakeholder(s)	Description
	understanding the needs of farmers so as to expand services. It currently partners with the WHO and the Institute for Social Action (INAS) to make payments to beneficiaries.
Product: e-Mola (mobile money) Implementer: Movitel Donor: N/A	Movitel currently has the largest coverage in rural areas in Mozambique. While e-Mola is relatively new, it has ramped up its agent network in the last couple years. Anecdotally, according to PREMIER, e-Mola agents are well supported with cash and producers know about the service.
Product: RekargaAki, MobiTop-Up, Sislog and Pay-Tek (mobile money) Implementer: Various Donor: N/A	A slew of secondary, mobile-money adjacent services are developing in Mozambique. With 4,000 current agents, RekargaAki is the largest. ¹⁴¹ The service allows individuals to pay bills (gas, water, TV, etc.), buy insurance (such as from Hollard), and recharge vouchers for any of the three major mobile money operators. The other three listed are much smaller, but growing organically in Mozambique.
Product: CommunityPass Implementer: Unknown Donor: Mastercard, DFC	In 2022, the Mastercard Foundation, in partnership with the U.S. Development Finance Corporation (DFC) announced a \$50 million program to implement its CommunityPass ¹⁴² platform in Africa, including in Mozambique. ¹⁴³ The platform appears to integrate mobile money and other financial services through a digital ID and appears to function on smartphones. According to one stakeholder, the program is currently funding the implementation of the platform among 200,000 beneficiaries in Nampula, Zambezia and Manica, however the assessment team could not find any information or confirm the status of the activity.
Product: Revolving Credit Savings (PCS) Implementer: IDEPA Donor: N/A	Championed since 1992 in the fishing sector, this model of financing has been appealing to Mozambican communities particularly given poor bank coverage, and excessive bureaucracy to open a bank account, and is cheaper than microfinance services. Low transaction and interest costs. Currently IDEPA, the Ministry of Fisheries, manages 1,000 active groups throughout the country engaging in PCS. Groups are made up of members of the same community and consist of between 10-30 members. The average interest rate is 10 percent (compared to 25-28 percent in banks) and average repayment length is 3 months. The system helps to serve rural areas where there is no bank coverage and ensures that those who might not be able to get a loan traditionally from banks can get one. The model is especially important because many rural inhabitants do not have identification or collateral to set up bank accounts and access loans and interest rates are very high. While there is currently no mobile support for this model, according to interviews, some mobile money operators are interested in pursuing or are currently developing software to serve this market. IDEPA indicated that they'd like to formalize savings groups, but are looking for support in how to do so.
Product: MSME loan fund	GAPI is a national private financial institution, with a minority state-owned share. The institution works primarily in economic development of agriculture and fisheries sectors, through guarantees that reduce risk of investment from entities like banks. Currently GAPI works with five banks: BIM,

¹⁴¹ Recargaki. Online at: <http://www.recargaki.co.mz/Recargaki-Website/>

¹⁴² Mastercard. *Community Pass*. Online at: <https://www.mastercard.com/global/en/business/governments/community-pass.html>

¹⁴³ Mastercard. 2022. *With focus on Africa, new DFC and Mastercard collaboration to provide up to \$50 million in potential financing to enable digitization and financial inclusion*. Online at: <https://www.mastercard.com/news/press/2022/december/with-focus-on-africa-new-dfc-and-mastercard-collaboration-to-provide-up-to-50-million-in-potential-financing-to-enable-digitization-and-financial-inclusion/>

Product and stakeholder(s)	Description
Implementer: GAPI Donor: USAID	<p>FNB, Banco Terra, BCI and ABSA. Recently, GAPI has worked with bilateral partners such as the Danish embassy (project Agrogante/Agroemprender) and USAID to launch funds that have guaranteed investment in the agricultural sector, mostly in the form of technical assistance to SMEs. Outside of these large partnerships, GAPI has successfully attracted small and medium sized banks to invest in the agricultural sector, however an interviewee noted that most banks tend to invest in other sectors that have similar guarantees and pose less risk than agriculture. The interviewee also noted that agriculture financing programs are not new in Mozambique and indicated that many in the past have failed because they have not adequately prepared the demand-side to comply with financing requirements. In this regard, a successful financing mechanism would also need to include training for demand-side actors on financial literacy and management, provide market linkages, and formalization. GAPI currently supports 3,200 savings groups including financial literacy training. In March 2023, GAPI signed an accord with USAID to launch a \$4.5 million support fund with the goal of financing approximately 3,000 MSMEs, many of which would be in the agriculture sector.¹⁴⁴ According to the press release, “the fund will prioritize small scale enterprises in the agricultural value chain and food systems, particularly those owned or managed by women and young people.”¹⁴⁵ Four million dollars of the \$4.5 million will be disbursed through the USAID SPEED project.</p>
Product: Input loans and grants Implementer: MADER Donor: N/A Project: SUSTENTA	<p>MADER’s flagship agriculture project SUSTENTA, gives grants and subsidies to producers. According to PREMIER’s 2023 financial ecosystem mapping document, the project offers a package of 60 percent grant and 40 percent loans for input supply for equipment and input purchases for PACEs (small-medium producers), though the extent to which PACEs knew about or utilized the service was unclear. MADER distributes credit in the form of “kits” of inputs to PACEs who then down-lend them to producers, with PACEs responsible for following up on these loans. Anecdotally, PACEs are struggling with managing these loans.</p>
Product: Weather indexed seed insurance; loan guarantee mechanisms Implementer: Hollard, Agritask, Phoenix Seeds, NCBA CLUSA Donor: Various, USAID, Austrian Development Agency Project: N/A	<p>Hollard appears to be the only major insurance player in the ag sector, offering weather indexed insurance for producers for rainfed seeds, as well as traditional insurance products for large producers and processors including production loss insurance. Hollard is currently utilizing Agritask, a large multinational company working across dozens of countries, to track weather, seed, and soil quality in Mozambique. Hollard has currently enrolled 60,000 small producers in its insurance. This could act as a major piece to resolve the climate risk aspect of financing. As recently as 2021, Hollard partnered with Phoenix Seeds to offer the first ever automatic weather-indexed seed insurance to a group of 20,000 farmers in Manica and Zambezia provinces. The partnership was facilitated through the SEEDS+ project funded by USAID and implemented by the National Cooperative Business Association¹⁴⁶ CLUSA International (NCBA CLUSA). NCBA CLUSA is currently implementing a \$1.5 million project funded by the Austrian Development Agency to reach 7,800 farmers in the Sofala province with climate smart agriculture and water services.¹⁴⁷ CrediSeguro, a project begun by Hollard in late 2021, used a digital platform to guarantee loans from banks and MFIs to agriculture SMEs in addition to establishing a credit risk mechanism.¹⁴⁸ The project offers 50 percent guarantees to prospective borrowers to use in lieu of</p>

¹⁴⁴ 360 Mozambique. 2023. *Cabo Delgado: GAPI, USAID and Government Launch \$4.5M Resilience Fund to Support MSMEs*. Online at: <https://360mozambique.com/economy/smes/cabo-delgado-gapi-usaid-and-government-launch-4-5m-resilience-fund-to-support-msmes/>

¹⁴⁵ 360 Mozambique. 2023. *Gapi, USAID and Government Launch MSME Resilience Fund*. Online at: <https://360mozambique.com/economy/smes/gapi-usaid-and-government-launch-msme-resilience-fund/>

¹⁴⁶ NCBA Clusa. *Mozambique: SEEDS+*. Online at: <https://ncbaclusa.coop/project/seeds/>

¹⁴⁷ NCBA Clusa. *Mozambique: Climate Smart Agriculture and Water (CSAW Sofala)*. Online at: <https://ncbaclusa.coop/project/csaw-sofala/>

¹⁴⁸ Club of Mozambique. 2021. *Hollard Seguros supports SME credit expansion in Mozambique*. Online at: <https://clubofmozambique.com/news/hollard-seguros-supports-sme-credit-expansion-in-mozambique-206620/>

Product and stakeholder(s)	Description
	<p>collateral as another player in this space. The assessment team was unable to verify if CrediSeguro was still functioning and interviews with Hollard did not cover the topic.</p> <p>The assessment team also found evidence of two additional insurance services: Movelcare microinsurance by TABECH and Digital Insurance solutions by CelsiusPro, however, could not verify if the products were active.</p>
<p>Product: Savings groups and mobile money linking Implementer: FARE Donor: Ayani</p>	<p>As long ago as 2017-2018, Ayani, a private international development consulting firm focusing on inclusive finance in over 60 countries, helped to increase the use of mobile money among savings groups in Mozambique. Working with FARE (Economic Rehabilitation Support Fund, a government initiative working to boost private sector enterprise), Ayani helped link 3,200 rural savings group members--mostly women--to mPESA mobile money accounts. Lessons learned included the importance of working through and offering training to a Savings Group Facilitator (a de facto leader of the group), transparency at agent-side on tariffs and fee structures for mobile money, a special tariff specifically for savings groups members, and a connection between the mobile money account and a bank so that savings accounts could be set up. While the project happened over five years ago, its lessons learned are still relevant for today.¹⁴⁹</p>
<p>Product: LISTA (financial literacy training app) Implementer: Fundacion Capital Donor: Ayani</p>	<p>Between 2022 and 2023, Fundacion Capital's LISTA application was used among 6,000 savings group members to enhance their ability to manage money and start a business. The app, which is facilitated on tablets by staff who travel from group to group, was found to encourage farming as a viable business and to strengthen the financial literacy skills of participants (PREMIER). Savings groups are thus also a place to combine supplementary activities, such as financial literacy.</p>
<p>Product: Dialogue platform Implementer: MADER, AMB, BM Donor: GIZ</p>	<p>MADER, the Mozambican Association of Banks (AMB) and the Banco de Moçambique (BM) are working together with GIZ on three pillars of financial inclusion: Pillar I – Access and Use of Financial Services (where MADER and GIZ are working to carry out an evaluation of existing initiatives for rural finance, with the aim of improving and identifying synergies with the private sector. The goal is to expand and diversify networks of access points to financial services), Pillar II - Strengthening of Financial Infrastructure, PILLAR III - Consumer Protection and Financial Education, which consists of financial education campaigns, training for civil servants, economic agents and commercial bank employees.</p>
<p>Product: Various technical support activities Implementer: FSDMoz Donor: SIDA (Swiss)</p>	<p>Financial Sector Deepening Mozambique (FSDMoz)¹⁵⁰ is a facility created in 2014 by funding from FCDO and the Swiss Development Agency (SIDA).¹⁵¹ The facility has a goal to expand financial inclusion and reach 2.6 million people and 1,000 businesses, targeting specifically the rural poor, women, and youth. With its first major tranche of funding in 2014-2021, FSDMoz helped over 130,000 people – two third of which were women -- access finance and supported over 230 businesses to receive new financial products. In its current iteration, FSDMoz is once again supported by SIDA to carry out a number of activities including research and studies, policy-level support to reform regulation, and innovation in the digital space.</p>

¹⁴⁹ Ayani. *Connecting Savings Groups to Mobile Money in Mozambique*. Online at: <https://ayani.nl/fare>

¹⁵⁰ FSDMOC. Online at: <https://www.fsdmoc.org.mz/>

¹⁵¹ DAI. *Mozambique—Financial Sector Deepening (FSDMoz)*. Online at: <https://www.dai.com/our-work/projects/mozambique-financial-sector-deepening-fsdmoc?ref=pubs.ghost.io>

CONCLUSIONS

In this section, we synthesize findings into overall conclusions about digital agriculture services and finance.

Digitization in Mozambique is still in the very early stages of development. To achieve truly successful and sustainable digital solutions, interested stakeholders must first address several key root problems limiting digitization. To begin with, Mozambique's weak infrastructure indicators will continue to hamper digital solutions into the future. Projects that do not have a functioning cellular infrastructure upon which to build will never achieve sustainability after the inevitable end of funding cycles. Strengthening cellular and broadband infrastructure will require addressing the problem at several levels. Hard infrastructure itself--at the most basic level, antennae--are not sufficient to cover rural areas in the country. Vodacom's recent expansion of 200 towers into rural areas is promising, but a weak enabling environment and low returns on investment act as major barriers to continued expansion. The problem may be lessened in the immediate term through concerted efforts at the policy level to enforce already existing laws in network sharing and interoperability of telecommunications infrastructure. Regulatory reform may also help to encourage and promote private sector investment in infrastructure through creative financing such as PPPs. Infrastructure build-out is a longer-term goal that could be supported by larger, multinational funding such as that of the World Bank. Starlink is a promising solution to increase coverage nationally, though only at an institutional level (e.g., within centralized, funded infrastructure such as schools, vocational institutes, and community centers) given its relatively high price tag.

Even with expanded communication infrastructure, the quality of telecommunications networks must be improved. Demand for digital services will reduce in the face of unpredictable and inconsistent cellular and broadband quality of service. While a law exists mandating operators to meet certain quality standards, persistent issues continue and critical telecommunications infrastructure need fixes and upgrades. Lack of clarity on roles and responsibilities of the various agencies and regulators contributes to lax enforcement of mobile operators and ISPs. Ensuring that operators abide by regulation and infrastructure is maintained will contribute to strengthened quality and higher demand for services. Working at a policy level to clarify roles and create an enforcement structure could prove worthwhile in this area.

Along with access and quality, cost is a critical challenge for uptake of digital services. While prices for data have fallen in recent years, they remain prohibitively expensive for most Mozambicans and definitively so for rural inhabitants. This is reflected in low ownership of mobile phones generally and a nearly nonexistent ownership of smartphones among farmers. The cost of sending SMS is prohibitively expensive for producers. According to stakeholders on the ground in Mozambique, the cost of USSD short codes is also very high relative to per capita income in Mozambique and deters investment from third party operators who bear the costs of a USSD model. The comparative high cost of these two methods (SMS and USSD) -- which are increasingly appropriate and necessary in the context of Mozambique-- is driven, in part, by lack of regulation and anti-competitive behavior on the part of mobile operators and banks. Reducing cost will be essential for the sustainability of solutions among farmers and also ensuring that private sector investors feel comfortable entering the digital ecosystem. Once again, clarity on roles and responsibilities and a structure for enforcement and regulation at the policy level would help.

The fourth key root cause of weak digitization prospects in Mozambique to be addressed is centers on digital literacy. Results from small-scale interventions in Mozambique in recent years prove that regardless of levels of literacy and prior experience with digital, farmers are eager, open, and willing to use digital technologies, especially if ICT solutions address their needs and priorities. A major barrier appears to be a simple one to overcome: lack of knowledge of what is available and/or how to use what they already have (e.g., phone) in a way that improves their lives. Community radio is the most comprehensive and powerful method of communication in rural areas and, combined with improved extension services and creative community-based digital training programs at central locations such as schools, community centers, and agrarian institutes, could prove to improve digital literacy at scale. By utilizing community-based approaches at schools and agrarian institutes, donors and

implementers can specifically target youth to change behaviors on agriculture while facilitating dispersion of digital services and information in communities.

Digital programming in Mozambique rarely matches the context. If a farmer owns a phone at all, chances are high that it is a feature phone. The farmer generally cannot afford a smartphone nor data, and the area in which the farmer lives most likely lacks infrastructure to connect to consistent and high quality Internet. In addition to all of that, the farmer may have irregular access to electricity to be able to charge the phone. Therefore, solutions that expect to reach the majority of farmers-- the 4.2 million SHFs mostly in rural areas -- must include SMS, USSD, and/or IVR components *in the local language*, taking into account infrastructure such as electricity and broadband coverage. As interventions take place closer and closer to urban and peri-urban areas with better backbone telecommunications infrastructure, projects might consider smartphone applications, but in a manner that is sustainable such as lease-to-own phones coupled with freemium subscriptions that do not rely on Internet access or purchasing data. Implementers and donors must consider the informational needs of farmers to ensure that a smartphone app truly is the right solution versus providing information platforms accessible by cheaper SMS or USSD systems. Proposed interventions could be piloted in areas already benefiting from some level of coverage, or among well-organized value chains such as cashew and cotton, as a relatively controlled environment before expanding to more rural or underdeveloped sectors. Platforms set up by donors must have a solid sustainability plan in place that emphasizes the continued and long-term management of an ICT solution by local actors and a realistic financial model whereby cost is not fully shifted onto customers after the project ends. Organized farmer groups such as cooperatives and savings groups where a lead facilitator can act as both a trained trainer and socialize the benefits of ICT solutions to members could be a promising vehicle to work through.

Given the underdeveloped state of agriculture in Mozambique, digital agriculture programming should focus first on basic knowledge and inputs. Farmers currently have little to no access to information on basic inputs or planting information. Interventions should focus on improving access to information on improved seeds and fertilizer, information on when to plant, and pertinent pest and weather-related information to strengthen resilience to shocks. Alleviating these problems will require a three-fold approach: improving information systems, improving extension services, and utilizing broad-based communication strategies. SIMA, the obvious candidate for an SMS market information system given its approval from MADER and the support of multiple bilateral agencies, could prove promising, however not only will it require a completed digitalization process but a realistic plan to acquire and update market prices frequently. In a country as vast and underdeveloped as Mozambique, saying so is much easier than doing. The system will only be as good as the accuracy and quality of the information that it can provide to producers who use USSD or reply with SMS. Viamo's 3-2-1 service, which is showing positive results in the health sector in Mozambique, as well as Nitadae's N'kalo app (among cashew farmers) offer private sector alternatives to consider.

Improving the services of extensionists-- which are at the same time trusted sources of information and solely undertrained-- can be achieved through digital solutions. Digital interventions have the potential to train extensionists at scale, remotely, via solutions such as offline training modules sent to smartphones with attendance and completion rates tracked. Recent experiences with Machamba are worth looking into. Involving and getting the buy-in of MADER and other agencies responsible for oversight of extensionists and a plan for refresher courses and continuing education will be key to sustainability of efforts in this area. A combination of local radio, proactive SMS messaging in the case of weather, pest, and planting events, and strengthened human capital via improved extension services could improve dissemination of basic knowledge to farmers at scale as a precursor to moving up to improved farming techniques.

When it comes to access to finance for the agriculture sector, mobile money has important implications for farmers but has considerable hurdles to overcome. Results of mobile money interventions, particularly integrated into savings groups, demonstrate general enthusiastic reception by farmers and encouraging outcomes. Women in particular appear to experience major benefits from its use including physical security of cash, increased savings, increased access to finance, and reduced travel time for transactions. However, considerable hurdles to mobile

money expansion remain. On the policy side, weak enforcement of regulation hampers interoperability and ease of use; concerted efforts in enforcing and regulating this law will be essential to increase the use of mobile money. On a more practical level, the lack of mobile money agents in rural areas severely limits any major scale up of mobile money. Agents will need to be incentivized properly to agree to work in rural areas and guaranteed sufficient float for transactions. Without a viable outlet to cash out or buy into mobile money, even the best attempts to increase mobile money usage will be limited. M-Pesa, which covers greater than 90 percent of the existing mobile money market, will be an essential ally in this endeavor-- not only as a means to test solutions but as a willing partner in regulatory reform activities that increase competition in a sector with comparably high fees for transactions. Encouraging interventions to improve and strengthen the mobile money agent network (and thus coverage) include initial forays into sharing of different mobile money agent networks, organic creation of additional, smaller mobile money companies, and the transformation of non-traditional vendors (e.g., agro-dealers, other value chain actors) into de facto agents themselves. Exploring avenues such as these as alternatives to the traditional agent structure could prove promising to scale up mobile money among farmers.

Savings groups provide an excellent venue to test out digital and mobile money interventions with the potential for scale. These groups are already a trusted source of finance for SHFs, particularly women, and are embedded in the culture and society of Mozambique. Indeed, banks and mobile money operators alike are exploring options to create formal financial products specifically for savings groups. Mobile money operators are currently interested in cutting out banks as middlemen for transactions altogether which would increase efficiency and lower cost. By working with pre-existing savings group networks such as IDEPA (more than 600,000 individuals) and Ophavela (175,000), donors and implementers could reach large numbers of farmers in a highly efficient manner. Because women make up such a large and pivotal part of savings groups, such interventions could constitute a major effort to reduce the gender divide with respect to digital and finance. Recent approaches and solutions from Kukula, GIZ, and Hivenetwork could be utilized as digital platform components of any savings group interventions.

Banks require more and better information as well as mechanisms to reduce risk before they will invest in smaller actors in the agriculture value chain. Currently, banks do not understand agriculture, do not know how to work in the sector, and do not trust the veracity of the data provided to them by MADER. Regardless of data availability, high risk in the form of climate and pest shocks pose major deterrents for banks to invest. Building a solid, high quality, and regularly updated database of producers will be essential to attract banks to the sector. GIZ has seen promising results in their FARM app program, which registered over 23,000 producers in well defined and established value chains. With their de facto proximity to producers, extensionists and agrodealers are the first rung up from producers and typically carry more advanced technology in the form of smartphones. These groups could be enlisted to help build such a database in the course of technical visits (extensionists) and purchases at shops (agrodealers). With more frequently updated and higher quality information on producers, including digitized regular records of financial transactions (from agrodealers) and, potentially, digitized asset registries (from extensionists), banks may be more willing to shift their lending portfolios further down the value chain. Such an approach would be essential considering that producers on the whole lack basic identification documents and physical collateral required by banks for financing. To counter larger, external risks to agriculture, working with Hollard to integrate insurance into financing packages may represent a promising way forward, however it will require relaxing regulations at the Central Bank as well to make the insurance sector more attractive for producers and lucrative for companies.

E-vouchers have the potential to solve several problems around access to finance up and down the agriculture value chain in one packaged intervention. The system not only provides access to financing through an 80 percent subsidy for input supplies, but critically it links producers with a network of local agrodealers. With a database of information about their potential customers, garnered through the e-voucher system, agrodealers could better manage stock and supply. Management skills training could be pushed to agrodealers and, combined with currently developing input supply forecasting and online ordering, agrodealers have the potential to improve their

management skills, have better planning and more consistent links with larger suppliers, and provide targeted and custom inputs for the producers they serve based on those producers' needs and timing. By capturing the transactions of producers through the e-voucher system, this also builds a financial transaction history of producers which could be used to apply for loans at banks or MFIs, disbursed through mobile money by the agrodealers who act as de facto mobile money agents, also increasing coverage of mobile money. An important component of the e-voucher approach is its placement of the agrodealer at the critical center of the model. Nearly all facets are managed through the agrodealer's smartphone and nearly all transactions can be done offline, including initial capture of producer information. Once the agrodealer begins to understand the client, they can predict what stock they will need and at what time. Over time, implementers could experiment with slowly reducing subsidies to ensure sustainability. Results from FAO's e-voucher pilot are encouraging, with several disparate groups of farmers across multiple provinces giving positive references.

Essential to any intervention will be a realistic exit strategy. Too many solutions in Mozambique have been limited by donor funding cycles and have proven unsustainable. Programs that offer subsidies, loans, and grants could consider gradual reductions in subsidies over time as beneficiaries become more comfortable and trust the services. Facilitators of cooperatives and savings groups should be trained to continue and manage systems to ensure knowledge is retained locally. There is little evidence to suggest that donors are working together to support similar interventions; establishing partnerships to ensure continuity of funding in promising interventions is a potential solution in this regard.

Tapping into pre-existing policy-level fora could help to strengthen efforts at the policy level.

Mozambique has passed a plethora of laws and regulations in recent years around ICT demonstrating a commitment to reform and creation of an enabling environment for ICT. GIZ and other actors have worked at the policy level to help the country implement its strategies, including the National Financial Inclusion Strategy, for some time. In addition, two active working groups convene donors and public sector actors on a regular basis to discuss ICT and financial inclusion at the policy-level. Contributing to these efforts and assisting in clarifying the roles of the myriad ICT-related agencies and regulators could help to build trust and facilitate results in policy, an area that has failed to catch up to technological progress. The Central Bank will be a pivotal actor to work with especially to update financial sector regulation. Working through the pre-existing efforts will add to legitimacy and demonstrate a willingness of all actors to work together to support common goals.

RECOMMENDATIONS

Below we present recommendations with supporting evidence. Recommendations are broken down into three categories: policy-level, access to finance, and information and market linkages. Recommendations are specifically for USAID and implementing partners of USAID-funded projects SPEED, PREMIER, and RESINA.

Policy-level

Recommendation	Rationale
<p>Work with INTIC, INCM, INAGE and other digital-related agencies and regulators to advance several policy-level agendas affecting digitization. This should include updating regulations to catch up to the expanding technology in the country, and building out a process to enforce the interoperability/ infrastructure-sharing law among telecommunications operators and increase open access to critical infrastructure. Work with the various public sector institutions to clarify their roles and responsibilities to reduce confusion for future activities. USAID could approach and work closely with GIZ in this area who is already working at the policy level with other agencies on digital-related aspects. In conducting this work, consider identifying a champion for digital services in key ministries and regulators to promote buy-in, legitimacy, and sustainability of efforts.</p>	<p>Before digital solutions can be effective, the country needs to improve communication infrastructure. This implies an expansion and improved quality of communication services, mainly in rural areas. The interoperability law on network sharing is not being followed by telecoms operators and could ease coverage and quality concerns in the short-term. Improvements in technology in the country have proven faster than regulation which must catch up. At the moment, stakeholders find the roles and responsibilities of the various public sector agencies muddled and confusing and are unclear of who to approach for certain activities.</p>
<p>Work closely with GIZ at the policy roundtable level through active participation in the CIFAM dialogue mechanism. Share USAID’s experience, vision, strategy, and resources in Working Group 3 on Digitization of the Agriculture Sector. Ensure considerations for inclusivity of populations such as women, youth, and others are built into the strategy.</p>	<p>CIFAM is a functioning and active mechanism where USAID can leverage its resources to have substantial impact given the high level exposure to policy and donor strategy. One of the working groups is specifically focused on digitization in agriculture which fits with USAID’s interests. Advocating for inclusion criteria at the policy-level could ensure a more sustainable approach to working with marginalized groups moving forward.</p>
<p>Work with GIZ and the Bank of Mozambique, to advance the goals of the Financial Inclusion Policy while it is still in its strategy phase. Encourage policy reform and enforcement of anti-competitive behavior among telecommunications operators in order to reduce cost of data fees and/or provide subsidies for mobile money transactions fees. Encourage reform to lower the insurance duties and relax requirements for bank account registration for SHFs.</p>	<p>The 2016-2022 Financial Inclusion Policy came to an end and now presents an opportune moment to help shape the next strategy. Much of the barriers around inclusion relate to high cost, spurred in large part by an anti-competitive enabling environment and lax adherence to regulations on the part of telecommunications operators. Insurance operators indicate that tax duties and overly burdensome bank account registration requirements hamper integration of SHFs into the formal financial system and make insurance less viable. The insurance law used by the Central Bank was last updated in 2001.</p>

Access to finance

Recommendation	Rationale
<p>Work with SIMO, BOM, and GIZ to help finalize the design for a digital financial product that integrates savings groups into the formal financial system. Involve and strengthen Hollard in the process as a means to integrate weather indexed insurance into bank loan packages to lower risk for banks. Build capacity of banks to better understand and lend to</p>	<p>Savings groups are well organized and embedded in Mozambican society and represent a viable vehicle for large-scale impact with respect to financial inclusion and digitization. Banks and mobile operators alike are already interested in digitizing and incorporating savings groups into the formal financial system. Banks currently lack detailed information on producers. Knowing the sector and the customer would make it easier to identify groups with financing potential and banks would have greater</p>

Recommendation	Rationale
<p>the agriculture sector through targeted training. Partner with IDEPA and Ophavela to socialize the product to savings groups, ultimately creating a viable database of savings group members to use for future loan-targeting purposes. Link data collected from extensionists to banks to add to the database of producers. As women are the majority of participants of savings groups, ensure that they play key lead roles in this area.</p>	<p>confidence to penetrate and finance the agricultural sector in Mozambique. Digitizing financial records could create a history of financial transactions that banks could use. Weather risk continues to be a major limiter for banks. Hollard's insurance reaches a relatively large number of producers and is the only one on the market to do so. If trained and equipped with digital solutions, extensionists could contribute to a future database on producers.</p>
<p>Focus on strengthening linkages between producers and agrodealers through piloting a new, or supporting the existing, e-voucher program. Involve MADER SUSTENTA to ensure no duplication of efforts and/or consider working with MADER to integrate the SUSTENTA input kit distribution onto the e-voucher system. Consider initial interventions in areas that already have some level of functioning infrastructure or among select closed and developed value chains to demonstrate impact. Consider funding/grant set asides for agri-entrepreneurship (particularly for youth) that takes advantage of the e-voucher model and any extra demand it generates.</p>	<p>The e-voucher system has garnered positive results and feedback from a range of stakeholders. It is reaching relatively large numbers of farmers. Evidence suggests it is leading to an increase in agribusinesses as well. The system incorporates subsidies in a cash-less voucher, enabling greater security and encouraging producer-agrodealer interactions which could facilitate more efficient procurement and supply chain management. SUSTENTA has a large geographic scope and provides critical inputs to farmers, yet is currently duplicative of the e-voucher in some areas. Digitizing the system provides myriad opportunities including establishing a digital history of transactions for farmers, improving stock management skills of agrodealers, and strengthening market linkages further up the value chain. There is disparate development and coverage of telecommunications infrastructure country-wide; initial positive outcomes from such interventions could be limited if carried out in areas of low infrastructure.</p>
<p>Continue to involve and work closely with GAPI on supporting key rural investments in agriculture to promote sustainability, legitimacy, and for local guidance. Disbursement of the \$4.5m MSME fund could be aimed at MSMEs utilizing specific digital solutions or encouraging MSMEs to use digital solutions. Given USAID's large investment in the fund, some proportion of grantees should constitute marginalized segments of the population.</p>	<p>GAPI appears to be one of the few well functioning investment and development entities in the country with a history of successful agricultural development initiatives. USAID through SPEED is donating the bulk of funds to the MSME fund and can guide the use of funds to certain key priority areas.</p>

Information and market linkages

Recommendation	Rationale
<p>Stimulate demand for digital services and increase digital literacy by helping rural schools, community centers, agrarian institutes, and TVET institutions connect to the Internet and providing them with digital content. Partner with Starlink to provide Internet, CIUEM for curriculum, and various other local NGOs and startups to provide content and training. Utilize community radio as a means to spread additional information about digital services. Build capacity of local radio station staff and consider a social behavior change campaign through the radio to stimulate use of information and ensure sustainability of efforts. Ensure that these programs are in relevant local languages. This will also be an avenue to incorporate digital entrepreneurship training for women and youth.</p>	<p>High data costs and infrastructure issues make expansion of viable and quality Internet services to rural areas via the traditional public sector unrealistic. Starlink is already in place and functioning in several rural agrarian institutes. Centralized institutes or centers can bear the initial high upfront and recurring costs of Starlink compared to smaller groups and individuals. This hub and spoke model allows for dispersion of learning benefits to the wider community, including skills and information on digital. Increasing learning opportunities through Internet access for youth could spur demand in agriculture and digital. Youth are well placed to benefit given the relative familiarity they have with technology. Training content and digital solutions already exist at myriad academic institutions and NGOs. Community radio is the most popular source of information in communities; results from previous projects demonstrate its ample reach; lack of local language use has been a limiting factor in the past.</p>
<p>Support a relatively low-tech education module solution for extension worker training and refresher</p>	<p>Stakeholders including MADER admit basic training problems for extensionists. Using digital technologies to educate and train extension</p>

Recommendation	Rationale
<p>courses. Work with existing NGOs and products (Machamba, Kuwaka, etc.) for efficiencies and to understand best practices from past attempts. Include MADER in the design and rollout to ensure sustainability and long-term commitment to extensionist training and appropriate content.</p>	<p>workers is a necessary first step for farmers to have access to quality extension services. Extensionists appear to be trusted by the community, yet less than 10 percent have benefited from their services. Apps and solutions (and their lessons learned) exist from previous donor projects that could be built upon to reduce development time. Extensionists are a finite population with frequent access to improved communications networks; they could potentially benefit from smartphone-based solutions. Continued and refresher education will be necessary to maintain knowledge.</p>
<p>Work closely with MADER and FAO to rigorously assess the potential of SIMA to carry out its mandate of dissemination of accurate market data. Involve Viamo and Nitadae to understand best practices in information dissemination. Any final system must contain SMS, USSD, and/or IVR functionality. Ensure that training focuses on topics such as use of seeds and fertilizer, planting times, and pest and weather information.</p>	<p>Producers have very little information on basic agriculture. Using information technologies to provide weather forecasts, basic planting tips, and the correct planting time to the producer can have an immediate and relevant impact. SIMA is already mostly built out and could constitute an efficient and effective avenue for information distribution, however the feasibility of accurate and quality data collection and dissemination must be tested. SIMA is also a MADER-led initiative which could help toward sustainability. On the other hand, Viamo and Nitadae platforms appear to be successful, having reached relatively large numbers with basic SMS and USSD services on basic agriculture. If farmers have mobile phones at all they are feature phones and data costs are extremely high, meaning offline and cellular (non-data) based solutions are best placed to reach producers.</p>

ANNEXES

Annex I: Stakeholders Consulted

Organization	Interview Date
Ministry of Agriculture and Rural Dev (MADER) / DCM	4/17/2023
MADER/ DNDP	4/17/2023
MADER/ DNDP	4/17/2023
MADER/ FAR	4/18/2023
Fund for Agrarian Development and Rural Extension (FAR)	4/18/2023
Mozambique Almond Institute (IAM)	5/26/2023
MADER/DNDP	4/17/2023
WFP/ ADM	5/25/2023
MADER/ DNDP	4/17/2023
Mozambique Commodity Exchange (BMM/ICM)	4/26/2023
MTA/DNTs	4/26/2023
MTA/DINAF	4/26/2023
Ministry of Health	5/26/2023
Ministry of Transport and Communication/INCM	4/20/2023
IRLG	4/12/2023
RESINA	5/25/2023
PREMIER	4/14/2023
RCC	5/17/2023
SPEED	5/18/2023
Data 4 Moz	4/6/2023
Star Link	4/13/2023
FAO	4/13/2023
UNIDO/Cooperative Barue	25-abr.
Gotopemba	4/24/2023
National Institute of Technology and Information (INTIC)	4/24/2023
National Institute of Electronic Government (INAGE)	5/20/2023
Vodacom	5/24/2023
Tmcel	27-abr.
Movitel	4/27/2023
Central Bank	28-abr.
Banc ABSA	4/28/2023
SIMA	5/15/2023
Mulheres de Poupança de Nathite	5/10/2023
Cooperativa Khanimambo Frelimo (Sequeiro)	5/11/2023
Associação agrícola de Licoma	5/10/2023

Organization	Interview Date
Associação Hama Ibadja 2	5/12/2023
Ass. Eduardo Mondlane	5/12/2023
CARE	5/9/2023
KUKULA	5/27/2023
IDPPA	5/22/2023
GAPI	5/22/2023
Mastercard	5/25/2023
PAE Measures	5/26/2023
Hollard	5/27/2023

Annex 2: Analytical Framework

Mozambique has a high percentage of rural population with 70% of the poor populations living in rural areas¹⁵². Agriculture in Mozambique is predominantly practised by smallholder agriculturists who account for 94% of the production¹⁵³. Despite low productivity agriculture remains the main source of food and income for 70% of the population and employs 70.2% of the workforce¹⁵⁴. Given agriculture is the backbone of the Mozambican economy, it becomes important to understand the ways of improving production and promoting resilience in advancing socio-economic development.

Some of the systemic issues in agriculture involve climate vulnerability, access to finance/insurance and investment, limited access to market, and asymmetric information¹⁵⁵. Despite the potential for digital technologies to enhance productive capacity by increasing efficiency within agricultural value chains they are beset with their own set of infrastructural and connectivity challenges. All the same, there is increased proliferation and use of digital solutions within the agricultural sector in Mozambique. This highlights a need to understand the level of digitisation within Mozambique's agricultural sector and the challenges and opportunities therein, which would help identify areas for targeted programmatic intervention by USAID/Mozambique.

This digital agriculture ecosystem assessment is a step in that direction. USAID's digital strategy defines a digital ecosystem as one comprising of stakeholders, systems, and enabling conditions that supports individuals and communities to access services, engage with one another, and pursue economic opportunities. This assessment will, accordingly, begin by mapping digital agricultural solutions and tracing associated stakeholders, systems, and policies to understand the existing digital landscape, and gaps and needs therein, to inform future programme planning.

Analytical Framework

This analytical framework follows the USAID Digital Agriculture Ecosystem Assessment Toolkit (Toolkit) designed to assess the level of digitisation in a country's agricultural sector, and is based on pilot digital agricultural ecosystem assessments conducted in partnership with USAID Missions in Bangladesh, Burkina Faso, Haiti, Honduras, Malawi, Mali, Nepal, Niger, Tajikistan, and Uganda. The Toolkit builds on the structure of the Digital Ecosystem Country Assessments (DECA)¹⁵⁶ and seeks to assess digital agriculture challenges and opportunities, and subsequently inform the development of recommendations for USAID programming to address such identified needs.

USAID defines the digital ecosystem as framed around 3 separate and overlapping pillars:

- Digital infrastructure and adoption
- Digital society, rights, and governance
- Digital economy

Additionally, four cross-cutting issues --inclusion, cybersecurity, emerging technologies, and geopolitical positioning – must be considered within each pillar. This framework provides a starting point for identifying the realities of a digital agriculture ecosystem within a given country, and diagnosing needs – and opportunities to address them – by the USAID Mission.

This study seeks to identify and address the challenges within the Mozambican agricultural sector which include: knowledge gaps, asymmetric information, financial exclusion, and (constrained) access to markets and the potential

¹⁵² FAO and ITU. 2022. *Status of digital agriculture in 47 sub-Saharan African countries*. Online at: <https://doi.org/10.4060/cb7943en>

¹⁵³ Inquerito Agricola Integrado (IAI), 2020.

¹⁵⁴ See supra note 1.

¹⁵⁵ The Commonwealth. Digital Agriculture Chapter 2: Commonwealth Africa. Online at: <https://thecommonwealth.org/digital-agriculture/chapter-2-africa>

¹⁵⁶ USAID. Digital Frontiers, DAI. 2022. Digital Ecosystem Framework. Online at: https://www.usaid.gov/sites/default/files/2022-05/Digital_Strategy_Digital_Ecosystem_Final.pdf

for digital technologies to address or mitigate them¹⁵⁷. The assessment will begin by mapping prospective solutions and associated stakeholders, systems, and conditions. The assessment will then analyse these solutions within the framework established by the Toolkit; the key parameters of this framework are elaborated below:

- **Digital infrastructure and adoption:** Refers to the resources that makes digital systems and services possible and the way individuals and organisations are able to access and use these resources. The components of digital infrastructure involve:
 - Connectivity infrastructure: The foundational components that enable the use of data and digital devices. These can include fibre optic cables, cell towers, satellites, data centres as well as innovative technologies like TV white space and community networks.
 - Security, interoperability, and competitiveness: Involves the conditions for a healthy telecommunications market covering government regulations and policies promoting innovation, lowering costs, and the degree of interoperability among services.
 - Affordability: Involves the cost of connectivity in relation to local income covering devices, maintenance, and data costs.
 - Digital literacy: Relates to the ability to use digital technologies to expand economic opportunities and participate in social and political life.
 - Digital divides: Relates to the conditions that structure access to digital technologies based on gender, race, ethnicity, disability, economic status, geography, sexual orientation, language, refugee status, and age, among other factors.
- **Digital society, rights, and governance:** Involves the legal and regulatory environment around data protection, access to data, and government services providing an enabling environment to support the growth of agri-tech businesses and providing assurance to potential users of the safety of their data, thereby promoting adoption.
- **Digital economy:** This pillar helps explore the role of technology in expanding economic opportunity and efficiency. It assesses the opportunities and challenges in adoption of digital financial services, e-commerce, and other solutions targeting access to markets, services, and assets.

The following 4 cross-cutting issues further impact the extent to which digital technologies are able to promote participation, security, and efficiency, and competitive advantage:

- **Inclusion:** Determines the extent to which marginalised and vulnerable populations can participate in the social and economic gains promised by digital technologies. Women and girls face social barriers in accessing and using digital technologies and have a lower digital literacy than men and boys. Further, persons with disabilities face significant barriers in accessing digital financial services and e-commerce platforms.
- **Cybersecurity:** Involves establishment of appropriately located processes to protect ICT systems and infrastructure from damage and unauthorised use or attack. This involves the protection of critical internet infrastructure, government data and IT systems, cross-border data flow agreements, consumer protection, and protection against cyber-attacks.
- **Emerging technologies:** Entails exploring the existing landscape of emerging technologies like artificial intelligence, blockchain, and internet of things within the agricultural landscape, and how these technologies already – or may eventually – shape access, efficiencies, and risks.
- **Geopolitical positioning:** Understanding how a country’s approach to digital transformation may be shaped or influenced by its geopolitical relationships, particularly in consideration of technology-enabled authoritarianism.

The study will also incorporate insights from reports on *Unlocking digital economy in Africa: Benchmarking the digital transformation journey* by SMART Africa and Digital Impact Alliance (DIAL)¹⁵⁸; the *Digital Agriculture Country Study (DACS): Mozambique* by the Centre for Coordination of Agricultural Research and Development for Southern

¹⁵⁷ See supra note 5.

¹⁵⁸ DAIL. 2020. *Unlocking the Digital Economy in Africa: Benchmarking the Digital Transformation Journey*. Online at: https://dial.global/wp-content/uploads/2020/10/SmartAfrica-DIAL_DigitalEconomyInAfrica2020-v7_ENG.pdf

Africa (CCARDESA) and World Bank¹⁵⁹; and the World Bank's *Digital Economy Diagnostic for Mozambique*¹⁶⁰. DACS serves as the early baseline and snapshot of the general digital agricultural ecosystem in Mozambique and identifies areas for further exploration. In providing an overview of the existing needs within the digital agricultural landscape it aims to inform programme interventions in moving beyond multiple fragmented interventions and towards a high-level cross boundary approach that maximised complementarities needed for building an inclusive agricultural economy¹⁶¹.

¹⁵⁹ CCARDESA. 2021/2022. *Digital agriculture country study Annex: Mozambique*. Online at:

<https://www.ccardesa.org/sites/default/files/knowledge-products/CCARDESA%20Digital%20Agriculture%20County%20Study%20-%20Mozambique.pdf>

¹⁶⁰ The World Bank. 2019. *Mozambique Digital Economy Diagnostic Executive Summary Report*. Online at: <https://thedocs.worldbank.org/en/doc/833211594395622030-0090022020/original/MozambiqueDECA.pdf>

¹⁶¹ See supra note 7.

Annex 3: KII Question Sets

Discussion guide for interviews with financial institutions and credit providers

This document outlines suggested themes for the interviews with financial institutions and credit providers. It offers a menu of questions under the key themes identified in the analytical framework. We will select and tailor questions and prompts for each interview, depending on their area of expertise. Interviewees will not be asked all questions in the guide.

Text in italics denotes instructions for the interviewer.

Introduction

- Thank you for agreeing to speak with us today. As explained in the email that was sent to you, we are conducting an assessment on behalf of USAID/Mozambique and the USAID Bureau for Resilience and Food Security assessing the Digital Agriculture Ecosystem in Mozambique. The assessment is being led by Athena Infonomics (the organisation I am working for), in partnership with DAI. To do this, we are speaking with a range of external stakeholder who xxx
- This interview will last for approx. XX min and will remain confidential. Comments will not be attributed to individual stakeholders, unless requested. We would normally record the interview for reporting purposes. The recording would only be used by Athena Infonomics for reporting purposes. **Do you consent to have this interview recorded?**
- Do you consent to have your name and organisation referenced in this assessment?

General

- How long have you been operating in Mozambique?
- How many customers do you have?
- What type of product offerings do you have for the agricultural sector? Which of these are delivered or offered digitally? How many customers are using these products?
- Who are your customers? (i.e. farmers, MSMEs, etc.) and where are they located?
- What is the key problem that you are trying to solve through your product(s)?
- Did you engage with any target customer group when designing your product?
- In your opinion, do you think farmers are perceived as high risk clients? If so, why?

Loans

- How many lending customers do you have? What percentage of those lending customers are in the agricultural sector (farmers, agro-dealers, etc)?
- Describe your typical loan terms for the agricultural sector (rate, length, fees, collateral)?
- What percentage of your loan portfolio (by volume or number of transactions) finances the farming sector and rural agri-enterprises (including non-farm)?
- What do you consider to be the challenges and risks involved in extending loans to the agricultural sector?
- What are the basis on which loans are rejected?
- What are challenges in extending coverage within the sector?
- How much in deposits do you have from rural customers?
- What data needs do you have? What data do you struggle to get from potential customers when making lending decisions?
- Do you ever utilise third party data for lending decisions?
 - If no, why not? Would you consider it?
 - If yes, who are your third party partners? What sort of data sharing frameworks do you use?
- What data are you leveraging and how? What is the commercial agreement to use the data?

Insurance offering

- Do you offer or partner with insurance companies that offer index insurance? Do you have any input company insurance clients?
- Number of insurance customers?
- Total hectares insured (if possible)?

For digital product offerings [if no digital product offerings available move to 'For No Experience with Digital' and following]

User experience and usability

- What do users have to say overall about your digital product offering?
- What are the key challenges that farmers face in using it? Have you addressed those challenges? How?
- How are you reaching more customers with these digital product offerings?
- Can you share your fleet statistics? active users? How did this number evolve in the past year? in the past 3 years?
- What motivated its implementation and what challenges should have been alleviated?
- How have the following factors constrained adoption or shaped your design choices?
 - Availability and quality of connectivity
 - Devices owned by farmers
 - Affordability of mobile services and data
 - Other applications used by your customers (social media, mobile money, etc.)
 - User concerns about privacy, data protection, or security
- How do you envision your product evolving over the next 5-10 years?
- Do you cooperate with mobile network operators?

Drivers and barriers to adoption of digital product offerings

- What technology/phone (basic, smart) is needed for your digital tool? USSD/SMS/IVR, 2G/3G/4G
- How do your services depend on interoperability between other services and infrastructures?
- What is the level of connectivity required for your services?
- Does this become a challenge in reaching some customers? If yes, could you please explain.
- What languages is your product in? Is this a barrier to adoption?
- Can you estimate what proportion of your users are women?
- Have you seen differences in how your product is used by men versus women?
- Do you have/plan to have a strategy to reach more women? Please explain.

Data and regulations

- What data is collected? Do you collect PII (personal identifiable information)?
- If so, what steps do you take to keep it secure?
- Do you have any data confidentiality policy publicly available to users?
- Where is that data stored? Is the data protected?
- Who owns the data?
- Do you share the data with any other stakeholders? If so, with whom?
- Do you feel the regulatory environment supports the safe and secure use and reuse of data?
- Do you have concerns about the safety of your systems and infrastructures?
- What are some of the regulatory/policy initiatives in your country which have made it favourable for you to operate in the digital ecosystem?
- What are the main regulatory challenges you face in your business operations?

- What do you see as the main opportunities for strengthening the policies and regulations affecting digital agriculture?
- Are you currently or have you been involved in the past in any Government programme for subsidies into the rural and agricultural sector? If so, elaborate (loan based and other subsidy programmes)
- In your opinion, what can be done to improve the digital agriculture ecosystem? (policy, infrastructure, financing, etc)

For no experience with digital

- Please discuss why you have yet to utilize digital services to reach customers?

Conclusion

- How has the COVID-19 pandemic and accompanying restrictions impacted your business/ use of your digital product(s)?
- Do you have anything else you would like to add/clarify?
- Any final thoughts or advice you would like to share with USAID?
- Can you refer us to any individuals, institutions or literature for further interviews/inquiry?

Discussion guide for interviews with agritech

This document outlines suggested themes for the interviews with agritech. It offers a menu of questions under the key themes identified in the analytical framework. We will select and tailor questions and prompts for each interview, depending on their area of expertise. Interviewees will not be asked all questions in the guide.

Text in italics denotes instructions for the interviewer.

Introduction

- Thank you for agreeing to speak with us today. As explained in the email that was sent to you, we are conducting an assessment on behalf of USAID/Mozambique and the USAID Bureau for Resilience and Food Security assessing the Digital Agriculture Ecosystem in Mozambique. The assessment is being led by Athena Infonomics (the organisation I am working for), in partnership with DAI. To do this, we are speaking with a range of external stakeholder who xxx
- This interview will last for approx. XX min and will remain confidential. Comments will not be attributed to individual stakeholders, unless requested. We would normally record the interview for reporting purposes. The recording would only be used by Athena Infonomics for reporting purposes. **Do you consent to have this interview recorded?**
- Do you consent to have your name and organisation referenced in this assessment?

General

- When was your company incorporated and how long have you been in operation?
- How many employees do you have?
- Where are you located?
- What is the geographical spread of your solutions?
- Which areas are your solutions most concentrated in?

Digital agriculture technology overview

- Could you please tell me more about the digital solution(s) your organisation is providing and how it creates an impact on farmers' life? What are the key challenges this digital solution is trying to overcome?
- When did you start offering these digital solutions? Who were your first customers (e.g. farmers, agrovets, Coops, youth, women, etc)? How has it expanded since in terms of customer reach? What has worked and not worked when rolling out the solution?
- How many users do you have?
 - Active users?
 - By type? (i.e. farmer, agribusiness)
 - By gender?
- Do you collect statistics on the primary user profiles? If so, are you willing to share them?
- Do you offer the tool in local languages? Which languages? Has this affected scalability?
- What challenges have you faced in reaching scale?
- How do you generate revenue from this digital solution and from whom? (e.g., user subscriptions, improved revenue through improved purchases from farmers)
- Do you plan to pursue/extend your digital solution in the upcoming years? How?
- If you were to change anything about your solution/platform and/or its implementation, what would it be? Examples can include: specific stakeholders; secure funding; including sustainability from the planning phase, etc.

Infrastructure required

- Please describe the network requirements for your digital solution to function (e.g., offline, 2G)?
- What are the main gaps in basic infrastructure that are affecting the scaling up of your business?
- What recommendations do you have for strengthening the infrastructure for digital solutions?
- Does your solution integrate with other platforms? (e.g., Whatsapp, mobile money, etc) Please describe.
- What are opportunities and challenges around interoperability?

Users' drivers and barriers to use the digital agriculture technology

- Have you conducted a 'willingness to pay' study? Are farmers willing to pay for your service? If yes, how much?
- Are you utilizing any subsidy schemes for you or your clients? How are they performing?
- Do you have any data / observations around cost of the digital tool compared to cost savings from its use?
- What are rural actors such as farmers', agripreneurs' and cooperatives' appetite and capacity for digital agri-tech tools/solutions?
- How was the design of your product shaped by:
 - Connectivity available to your target audience?
 - Device ownership and digital literacy of your target audience?
 - Other digital services used by your target audience (social media, mobile money, etc.)?
 - User concerns about privacy, cost, or other factors?

Use of data and regulations

- How does the tool collect data?
- What data is collected? Do you collect PII (personal identifiable information)?
- If so, what steps do you take to keep it secure?
- Do you have any data confidentiality policy publicly available to users?
- Where is that data stored? Is the data protected?
- Who owns the data?

- Do you share the data with any other stakeholders? If so, with whom?
- Do you feel the regulatory environment supports the safe and secure use and reuse of data?
- Do you have concerns about the safety of your systems and infrastructures?
- What are some of the regulatory/policy initiatives in your country which have made it favourable for you to operate in the digital agri-tech ecosystem?
- What are the main regulatory challenges you face in your business operations?
- What do you see as the main opportunities for strengthening the policies and regulations affecting the digital agri-tech ecosystem?

Tech start-up space

- Did you ever envision partnering with other ICT implementers working in digital ag? If yes, what would be the advantages?
- If not, why?
- What, if any, competitor digital tools are you aware of? How is your product differentiated?
- Does your business model allow you to extend your project on your own funds or would you be seeking additional funding from DPs, INGO, etc?
- In your opinion, are there any ICT groups or accelerators that promote the use of ICT tools in the Country? Ag sector? If yes, who are those groups and what challenges do they face?
- Have you used tech hubs (innovators, accelerators, co-working spaces) to get your business to where it is today? If yes, why? If no, why not?
- What is your perception of the quality of start-up clusters present in the country? Can you provide specific examples?

Human capital

- Is your solution developed and maintained locally? If yes, What are the needed skills? What challenges do you face?
- If not, how is support and maintenance provided? If support and maintenance are outsourced, what impact does it have on your end-users?
- What key skills do you look for in new hires? In your experience, how easy or hard is it to find talent for Digital Agri-Techs? If it's hard, how do you overcome these challenges? Has this changed over time?
- Are universities or training institutions adequately preparing graduates with tech-focused and business degrees for companies like yours?
- What are some of the recommendations that you have to improve the availability of talent pools for the Digital Agri-Tech ecosystem?

Conclusion

- How has the COVID-19 pandemic and accompanying restrictions impacted your business/ use of your tool?
- Any final thoughts or advice you would like to share with USAID?
- Who else would you suggest we speak with? Can you provide contact information?

Discussion guide for interviews with Demand actors (Farmers, Farmer Organizations, Cooperatives, agribusinesses and other agritech users)

This document outlines suggested themes to increase knowledge of demand-side digital agriculture actors in Mozambique (including any involved in the use of satellite image analysis), and the barriers to uptake of digital agriculture services. The assessment findings should help in understanding existing digital tools, barriers/constraints of digital innovations, and how digital tools can be leveraged to increase agricultural productivity within the scope of future USAID programming.

Text in italics denotes instructions for the interviewer.

Introduction

- Thank you for agreeing to speak with us today. As explained in the email that was sent to you, we are conducting an assessment on behalf of USAID/Mozambique and the USAID Bureau for Resilience and Food Security assessing the Digital Agriculture Ecosystem in Mozambique. The assessment is being led by Athena Infonomics (the organisation I am working for), in partnership with DAI. To do this, we are speaking with a range of external stakeholder who xxx
- This interview will last for approx. XX min and will remain confidential. Comments will not be attributed to individual stakeholders, unless requested. We would normally record the interview for reporting purposes. The recording would only be used by Athena Infonomics for reporting purposes. **Do you consent to have this interview recorded?**
- Do you consent to have your name and organisation referenced in this assessment?
-

General

- Can you please describe your (the person) role in the organization?
- What is your education level? How long have you been working in the organization?
- How do you describe the core mandate of your organization in the agricultural sector in Mozambique?
- How long has your organization been in operation?
- In what geographic areas does it operate? Does it work at the provincial or district level?
- For organizations, how many members do you have?

Programming Overview

- How do members benefit from being part of the Unions/ Cooperatives/ Associations?
- Are you aware of relevant information and innovations in agri-tech?
- For organizations, if yes, can you give an example? Do you disseminate them among your members?
- How do you disseminate information on relevant innovations and information from Digital Agri-Techs to the farmers?
- How do you understand the role of digital technologies in agriculture?
- Do you consider yourself a part of the agri-tech ecosystem?
 - a. If yes, do you see yourself playing a role in the agri-tech ecosystem in the next 5 years?
 - b. If yes, how?
- What role have you played in ensuring that farmers integrate technology in their farming practices?

Data/Information Needs

- What type of agriculture data/information does your organization try to obtain?
- List all the information data that is relevant to your association and explain its relevance to your activities.
- Where does this information come from?

- a) Community radio/television
- b) Internet
- c) Newspaper
- d) Social media
- e) Other - please specify
- How would you like to access the information differently? How and why?
- Is the information used by your association accessible for free?
- How would you describe the quality of the information your organization has access to:
 - Exhaustive
 - Timely
 - Easy to understand
 - sufficient
 - Other - please specify.
- Which languages is the information available in? Is the language important for you?

Digital in Agriculture

- According to you, what are the key barriers to agricultural productivity in Mozambique?
- What kind of information/ solutions could help overcome these barriers?
 - a. What is the best vehicle to deliver the proposed solutions/information?
- What are some of the key challenges in the agriculture sector in Mozambique which you feel can be addressed through technology innovations?
- What potential drawbacks would you see for digital solutions to organize service provision (rentals and maintenance)?
- Are there any digital solutions which you think could help solve some of the gaps in the input-delivery system?
- What are some of the key opportunities that could open up if the farmers incorporate agri-technologies in their agricultural practices?
- How do you manage and mitigate weather risks to crops?
- Have you encountered any successful digital solutions that have helped improve different aspects of agriculture (productivity, profitability, pests and diseases management, access to improved seeds, access to fertilizers, equipment acquisition, waste management, etc.)?
 - a. If yes, could you please explain?
- In your perspective, what is the existing supply of technology solutions for these challenges? In other words, is the demand for technology innovations being met?
 - a. How does this supply vary within the country?
- Which were some of the types of agricultural technologies that were popular 5 years ago?
 - a. What are the types of technologies that are popular today?
 - b. What has led to this transition?
- What role can other ecosystem actors play in promoting an innovation culture in agriculture, especially among youth?

Experience with Digital

If the organization is using Digital:

- Please tell us about the different digital tools and services your organization uses? *Collect information on the type of tool:*
 - a. Is it computer based?
 - b. smartphone?
 - c. basic phone?
 - d. Who uses it (farmers, staff, etc)?

- How did you hear/learn about the digital services you are using?
- What was the biggest incentive for taking on/transitioning to the use of digital ag tools in your work? What problem were you trying to solve?
- Did you ever discontinue using a digital tool or service?
 - a. If so, what was it and why did you stop using it?
- What was the uptake like within your company? How did you train staff?
- How would you rate your organization's use of the digital service(s) on a scale of 1-5 with 1 being Poor and 5 being Excellent?
- What challenges have you faced in rolling these digital services out?
 - a) Staff uptake?
 - b) Data Entry?
 - c) Connectivity?
 - d) Cost?
- How could these challenges best be mitigated?
- How relevant are Digital Agri-Techs to the mission of your organization?
- What has been your experience working with Digital Agri-Techs?
 - a. Please provide specific examples on interventions or areas where you've worked together.
- What would you say have been the greatest benefits you have gotten from the use of these digital tools?
- What other benefits do you hope to accomplish from using digital tools?
- Do you plan to use the digital service long term? Is it part of your company's success now?

If the organization isn't using Digital:

- Why have you not used digital technologies in your programs?
- What are the primary barriers to using digital technologies?
 - a) Cost?
 - b) Digital literacy?
 - c) Network connectivity?
 - d) Preferences?
 - e) Migrating systems and processes?

Opportunities for Digital at Organization Level

- What are some of the primary challenges your business faces? What takes up more of your time?
 - a) Flow of information and processes?
 - b) Communications internally?
 - c) Accounting / inventory?
- What are some of the main challenges members of your organization face?
- Do you think technology can alleviate some of these challenges?
 - a) If yes, how so?
 - b) If no, why not?
- Are there any non-digital aspects of your business that you believe could never be digitized?
 - a. If so, what are they and why?
- How could organizations best support you in adopting digital technologies?
- Which organizations are best suited to support you in adopting digital technologies?
- How can Digital Agri-Techs adapt to enhance their usefulness to organizations like yours?

Infrastructure

- What are the main gaps in basic infrastructure that are affecting your organization in advancing agri-technology to the farmers?
- What recommendations do you have for strengthening the infrastructure for Digital Agri-Techs? Of these recommendations, do you see your organization play a role in any?
- How would you rate the mobile network coverage where your organization is (0-5)? Where farmers are?

- Does your association have an Internet connection? If yes, what type of connection does your association currently have?
- How would you rate the connectivity (0-5)?
- How does your association pay the internet bills?
- How many farmers own a smartphone/phone/no phone in your association? Do you own a smartphone? (Estimated percentage)?

Affordability

- Agribusinesses: What types of financial services do your farmers use?
 - a. Do you offer any of those services to them (I.e. credit for inputs)?
- How affordable are internet access and mobile devices for your association members?

Digital Literacy

- Does your association receive capacity building/trainings? In which domain? in the ICT domain as well?
- How easy is it for your association to apply ICT acquired skills? If limited to low - ask why?
- What types of things do farmers in your association usually use their phones for (WhatsApp, SMS, mobile cash services, calls, etc.)
- Do they need/seek any training to use them?

Digital Divide

- How do mobile phone ownership and usage differ between men and women in the communities you work with?
- Does your association work with women? If yes, what do they usually do in the association? What is their average education level (primary school, secondary, etc.)?
- How do you think ICT initiatives can further support women within your association?
- Does your association work with young people? If yes, where do they usually work and why?
- What incentives could lead to young people being more involved in ag?
- Do you think technology and ICT tools can help them be more involved?
- What impact might increased digitalization have on gender inequality, particularly at the farmer level?

Data

- How do you protect the security of the data you collect? How big of a concern is data security for you? Are you aware of the data security mechanisms?

Government Services

- What digital services does the government offer farmers, if any?
- Does the government offer your organization support to adopt digital agri-tech tools and/or promote them to farmers?

Digital Financial Services

- Does your organization use digital financial services (mobile money)? If yes, how/when do you use it?
- Are farmers in your association using digital financial services? If yes, what percentage? If no, why not?
- Who is/are your service provider(s)?
- Does it allow you to be connected to another services provider? What challenges do you face (cost, connectivity, etc..)?

Conclusion:

- Any final thoughts or advice you would like to share with USAID?
- Can you refer us to individuals, institutions or literature for further interviews/inquiry?

Discussion guide for interviews with MNOs

This document outlines suggested themes for the interviews with MNOs and mobile money providers. It offers a menu of questions under the key themes identified in the analytical framework. We will select and tailor questions and prompts for each interview, depending on their area of expertise. Interviewees will not be asked all questions in the guide.

Text in italics denotes instructions for the interviewer.

Introduction

- Thank you for agreeing to speak with us today. As explained in the email that was sent to you, we are conducting an assessment on behalf of USAID/Mozambique and the USAID Bureau for Resilience and Food Security assessing the Digital Agriculture Ecosystem in Mozambique. The assessment is being led by Athena Infonomics (the organisation I am working for), in partnership with DAI. To do this, we are speaking with a range of external stakeholder who xxx
- This interview will last for approx. XX min and will remain confidential. Comments will not be attributed to individual stakeholders, unless requested. We would normally record the interview for reporting purposes. The recording would only be used by Athena Infonomics for reporting purposes. Do you consent to have this interview recorded?
- Do you consent to have your name and organisation referenced in this assessment?

I. General

- How long have you been operating in Mozambique?
- What is the % of your mobile internet customers in the total base? Could you share with me the % rural vs urban and men vs. female?
- How many active mobile subscribers do you have? Please define what active means. Could you break down the number of active subscribers by voice and data services?
- What are the key challenges in serving more rural customers? Female customers?
- What value added services do you provide to your subscribers?
- When you develop services, do you consider the needs of different customers such as women, youth, people with low literacy, people with disabilities?
- Could you please tell us about any other challenges that you face as a mobile operator, including security and extreme weather event challenges? Do you have any mitigation approaches to deal with insecurity?

Ib – Existing initiatives in the agricultural sector *[Use these questions for more information on a known service the MNO provides that is relevant to the agriculture sector]*

- Do you offer specific VAS services in the agricultural sector?

If yes:

-
- What scale have you reached with [service]? How many users do you have in total for this service? Disaggregate between active and total users. How have you rolled it out? Do you have plans to increase users in the future?
- What is the cost of this service?
- How is [service] available? USSD, SMS, IVR, web and/or app based? Why? Do you plan to make it available through other channels to reach more users? Why? If yes, which channels?
- What are some of the challenges that you have experienced with [service]?
- What were the mitigating measures?

- What are the lessons learned?

If no:

- Do you have any upcoming initiatives in the agricultural sector? *[get as much information as possible. If they don't have any initiative and are not planning any, try to understand why. Is it about lack of willingness to target the ag sector? Or willingness is there but they are facing other challenges?]*

2. Mobile money access and use *[for interviewer: check if MNO provides mobile money services]*

- What is the size of your active mobile money customer base (30 days active)?
- How many mobile money agents do you have? What proportion of those are located in rural areas?
- How has your mobile money agent base been growing over the last 3 years?
- What does your agent base look like in terms of gender, age? *[if one segment of the population stands out more, such as men over women or people above 35 years old over young, prompt to understand why this is so. Does the MNO face any particular challenge in recruiting a diversity of agents?]*
- Do you partner with third parties to develop your rural agent network?
- What are the challenges you face to expand mobile money in rural areas? *(eg. Any liquidity challenges? Availability of agents? Proximity to farmers?)*
- Does your mobile money wallet have any agriculture specific services integrated with it?
- Do you have any products that work specifically with rural savings groups?

3. Barriers to access to and use of digital services *[We are now going to talk about the different barriers to digital services...]*

3a. Infrastructure

- What percentage of the population do you cover with 2G? 3G? 4G? *[this question is about coverage provided by the MNO being interviewed]*
- What percentage of the country is covered by mobile broadband?
- How would you rate your overall broadband coverage in the cities? In the rural areas? Are you planning to expand your rural broadband network *[ask what they are planning in terms of 3G coverage and in terms of 4G coverage. In some countries, 3G coverage expansion is still predominant?]* When? What challenges do you face? How could these challenges be overcome?
- Would you be able to share your quality index in both the big cities and the rural areas? What do you see as the limiting factor for improving network quality?
- How often do you perform mobile network infrastructure scaling to improve coverage?
- Have you started rolling out 5G? If so, when and where? What are the plans for the next 2 to 5 years?
- Have you experienced any challenges in implementing the resources after each scaling? If yes, what are those challenges?

3b. Affordability

- Are you aware of any past/present/planned initiatives to reduce the cost of access to phones/smartphones in rural areas or for specific customer segments? *(e.g. offers to buy a handset etc)*
- Do you have any past/current/planned initiative to improve costs of access to mobile internet? Please explain. *(e.g farmer specific billing plan)*
- Are you aware of any initiative in *[name of the company]* to reduce costs of access to a smartphone?

3c. Digital skills

- How do your services cater to the needs of people with low literacy/low digital literacy/ language barriers?
- Are you offering digital skills training programmes to specific customer segments?

4. Digital society, rights, and governance *[let's now talk about the legal and regulatory environment around data protection, access to data, and government services]*

- Do you feel the regulatory environment supports the safe and secure use and reuse of data?
- What are some of the regulatory/policy initiatives in your country which have made it favourable for you to operate?
- What are the key policy challenges, if any, that you have faced? How can this be alleviated? What steps have you taken to overcome these challenges?
- Are there any support structures from the government that are available to you? Have you used them? Why or why not?
- Are you aware of any digital initiatives the government has in the agriculture sector?

5. Partnerships to improve digital agriculture

- Do you have existing partnerships with INGOs/govt/or other development actors on digital solutions? If yes, how have these impacted your business? Has it impacted your subscribers' perception of you?
- Have you partnered with agritech startups? If yes, how has it impacted your business? What scale have you been able to reach? What have been the challenges?
- If no partnering, – why not? Do you plan to in the future?

6. Human capital

- How do you source employees?
- What key skills do you look for in new hires? In your experience, how easy or hard is it to find talent? If it's hard, how do you overcome these challenges? Has this changed over time?
- In which departments / for which functions do you recruit most?

7. Conclusion

- Are there any specific region(s) in the country you're seeing as having great potential to generate new revenue streams from the agricultural sector? Why/why not?
- What impact might increased digitalization have on gender inequality, particularly at the farmer level?
- Do you have anything else you would like to add/clarify?
- Are there any actors you would like our team to meet that could be a key informant?
- Any final thoughts or advice you would like to share with USAID?

Discussion guide for interviews with Government

This document outlines suggested themes for the interviews with Government representatives. It offers a menu of questions under the key themes identified in the analytical framework. We will select and tailor questions and prompts for each interview, depending on their area of expertise. Interviewees will not be asked all questions in the guide.

Text in italics denotes instructions for the interviewer.

Introduction

- Thank you for agreeing to speak with us today. As explained in the email that was sent to you, we are conducting an assessment on behalf of USAID/Mozambique and the USAID Bureau for Resilience and Food Security assessing the Digital Agriculture Ecosystem in Mozambique. The assessment is being led by Athena Infonomics (the organization I am working for), in partnership with DAI. To do this, we are speaking with a range of external stakeholder who...
- This interview will last for approx. 45 to 60 min and will remain confidential. Comments will not be attributed to individual stakeholders, unless requested. We would normally record the interview for reporting purposes. The recording would only be used by Athena Infonomics for reporting purposes. Do you consent to have this interview recorded?

- Do you consent to have your name and organization referenced in this assessment?
- Do you have any questions or concerns before we start?

a) Ministry of Communication

As the ministry of communications, the interview will focus on assessing your current infrastructure; understanding your challenges and collecting your needs. We will also try to determine your involvement in ICT tools, especially in the agricultural sector. Finally, you will also be able to discuss ongoing or future ICT projects for the ministry.

Official mandate (this question is not necessary if the mandate has been reviewed)

- Could you briefly describe your mandate?
- Does it include any provision that promotes (or hinders) the use of ICT tools? If yes, how would you describe their implementation at national level?

Network infrastructure

- What services do you provide to: Other government agencies or External users?
- What is the state of interoperability in your country? Is there any interoperability initiative to promote digital/financial inclusion? What is your role as ministry of ITC in making services interoperable? What current challenges are you facing?

Challenges and needs

- Would you say that the current infrastructure supports your mandate?
- What challenges impact your ability to serve rural areas where farmers and other agri-stakeholders operate?
- What are your needs? (human capital, equipment, etc.)
- How would meeting these needs alleviate some of your challenges?

Involvement in ICT initiatives

- Are you involved in any ICT tools/applications for the agriculture sector?
- If yes, could you please detail them for us?
- If no, have you ever been approached for any? Could you please provide us with more details?

Ongoing/future projects

- Any ongoing/future extension plans or projects? If yes:
- What are the expected results?
- What is the estimated time of delivery?

b) Ministry of Agriculture

As the ministry of Agriculture, the interview will aim to better understand your mandate, and to assess if your current infrastructure supports it. We would also like to know if you are using any ICT tools to collect and share data with stakeholders in the ag. sector, understand your challenges and collect your specific needs for a sustainable digital ag ecosystem. The interviews will also collect data from your decentralized representations in the country's regions - as implementing agencies of ICT projects/tools. Finally, we will also touch upon ongoing or future ICT projects for the ministry.

Official mandate

- Could you briefly describe your mandate?

- Does it include any disposition that promotes (or hinders) the use of ICT tools?
- In your opinion, what are the key challenges to agricultural productivity in Mozambique?
- What kinds of policy solutions have been proposed to overcome these challenges? Have these policies been successful?

Network infrastructure and digital tools

- Do you use any digital agriculture tool in the ministry? If yes, List all tools, their status and their usage rate (Excel workbooks and Access Databases are analog tools that should also be included).
- Has the ministry deployed any external facing tools that are used by extension agents, farmers or others?

Tool Name	Location	Status (ongoing, reason discontinued)	Data Security Measures	Challenges

If no, try to find out if some tools were discontinued and why (ex. budget constraints, low capacity, unstable network, maintenance issues etc.)

Information sharing mechanisms

- In accordance with your mandate, do you have to share information with various stakeholders, from decision makers to farmers?
- How do you share information?
 - Reports in hard copies
 - Email or Newsletter
 - Website
 - ICT applications (If yes, list and collect specs)
 - Other
- Farmers and farmers associations are usually located in remote, hard-to-reach areas. How do you communicate with them?
- What seems to be the preferred communication channel? (local ministry representation, community radio and/or tv, etc.)
- Give the crop selling reference price example: how do you communicate selling reference prices to farmers?
- In accordance with your mandate, do you have to engage in supporting farmers activities such as i) training and capacity building on best farm practices; ii) pests and diseases; iii) M&E activities, etc. If yes, how do you plan and monitor those activities?

Challenges and needs

- In light of your mandate, Would you say that the current digital infrastructure supports your mandate?
- What are your main concerns?
- What are your main challenges?

Involvement in ICT initiatives

- Are you involved in any ICT tools/applications for the agriculture sector?
 - If yes, could you please detail it for us?
 - If no, have you ever been approached for any? Could you please give us more details?

Ongoing/future projects

- Any ongoing/future ICT projects? If yes:
- What are the expected results?
- What is the estimated time of delivery?

Ministry of Environment

As the ministry of Environment, the interview will aim to better understand your mandate, and to assess if your current infrastructure supports it. We would also like to know if you are using any ICT tools to collect and share data with stakeholders in the ag. sector, understand your challenges and collect your specific needs for a sustainable digital ag ecosystem. The interview will include a focus on weather data. Finally, we will also touch upon ongoing or future ICT projects for the ministry.

Mandate:

- Could you briefly describe your mandate?
- Does it include any disposition that promotes (or hinders) the use of ICT tools? If yes, how would you describe their implementation at national level?

Network infrastructure and digital tools

- Do you use any digital tool in the ministry? If yes,
 - List all tools, their status and their usage rate (Excel workbooks and Access Databases are analog tools that should also be included).
- Has the ministry deployed any external facing tools that are used by extension agents, farmers or others?
- If no, try to know if some tools were discontinued and why (ex. budget constraints, low capacity, unstable network, maintenance issues etc.)

Information sharing mechanisms

- In accordance with your mandate, do you have to share information with various stakeholders, from decision makers to farmers?
- How do you share information?
 - Reports in hard copies
 - Email or Newsletter
 - Website
 - ICT applications. If yes, list and collect specs
- Farmers and farmers associations are usually located in remote, hard-to-reach areas. How do you communicate with them?
- What seems to be the preferred communication channel? (local ministry representation, community radio and/or tv, etc.)
- Have you noticed differences in the channels that are effective for reaching men and women?
- Weather data is very important for farmers. Does your mandate include sharing weather data with farmers?
- Do you share this data? If yes, spontaneously or upon request? If spontaneously, where is this data available?
- Are you collecting and analyzing weather data?

Challenges and needs

- What type of digital infrastructure do you currently use?

- Would you say that the current digital infrastructure supports your mandate?
- What are your main challenges?

Involvement in ICT initiatives

- Are you involved in any ICT tools/applications for the agriculture sector? If yes, could you please detail it for us?
- Do you currently partner with actors in ICT to extract weather data? How?
- What are the most common weather data users ask for?
 - Daily weather (sun index, rainfall, humidity, etc.)
 - Forecast (how many days ahead)
- What technology do you use to collect those data [e.g. geospatial sensors, but also any other less advance technology on the ground]
How do you disseminate the data collected? To whom?
- How easy/difficult is it for your weather department to respond to all requests?
If difficult, what are the main difficulties?
- Do you have any issues in the accuracy of data? Have you used any ICT initiatives to help improve the accuracy of weather data?

Ongoing/future projects

- Any ongoing/future ICT projects? If yes:
- What are the expected results?
- What is the estimated time of delivery?

Telecom Regulator

As the regulating authority, the interview will aim to better understand your mandate, and to assess if your current infrastructure supports it. We would also like to know if, as a regulatory body, to what extent do your processes include ICT tools. The interview will also allow our teams to understand your challenges and collect your specific needs for a sustainable digital ag ecosystem. Finally, we will also touch upon ongoing or future ICT projects for the organization.

- Could you briefly describe your mandate?
- Does it include any disposition that promotes the use of ICT tools? If yes, how would you describe their implementation at national level? Do you have any regulatory framework in place that supports developing innovative services and connecting more people to digital services?
- What is the strategy around spectrum? Do you have a national broadband plan that includes a strategy for making sufficient spectrum available to the mobile industry for broadband development? Do you have requirement in terms of coverage for spectrum to mobile operators [e.g. requirements in terms of % of the population to be covered by broadband, specific locations/geographic area to be covered, specific roads. Uncover details on these requirements, year it started etc]?
- Is there any aspect of your mandate that limits your ability to promote the use of ICT tools?
- Do your regulatory processes extend to ICT tools and applications?
- What are the key challenges, if any, to digital policy in Mozambique?
- How has your department tried to build an enabling environment for digital innovation?

Network infrastructure

- What type of network infrastructure is currently active?
- What services do you provide to:
 - Other government agencies
 - External users?

Information sharing mechanisms

- In accordance with your mandate, do you have to share information with various stakeholders, from decision makers to farmers?
- How do you share information?
 - Reports in hard copies
 - Email or Newsletter
 - Website
 - ICT applications (If yes, list and collect specs)
- How do you share information?
- Have you noticed differences in the channels that are effective for reaching men and women?

Challenges and needs

- Would you say that the current digital infrastructure supports your mandate?
- What challenges impact your ability to serve rural areas where farmers and other agri-stakeholders operate?
- Could you highlight any cybersecurity initiatives undertaken for the protection of critical infrastructures?

Involvement in ICT initiatives

- Are you involved in any ICT tools/applications for the agriculture sector?
 - a. If yes, could you please detail them for us?
 - b. If no, have you ever been approached for any? Could you please provide us with more details?

Ongoing/future projects

- Any ongoing/future extension plans or projects? If yes, what are the expected results? What is the estimated time of delivery?

Additional Questions

Conclusion:

- Where can players such as USAID focus to enhance the ecosystem for digital agriculture in the country?
- Is there anything else you think we should know?
- Can you refer us to any individuals, institutions or literature for further interviews/inquiry?

Discussion guide for interviews with NGO/Donors

This document outlines suggested themes for the interviews with NGOs/Donors. It offers a menu of questions under the key themes identified in the analytical framework. We will select and tailor questions and prompts for each interview, depending on their area of expertise. Interviewees will not be asked all questions in the guide.

Text in italics denotes instructions for the interviewer.

Introduction

- Thank you for agreeing to speak with us today. As explained in the email that was sent to you, we are conducting an assessment on behalf of USAID/Mozambique and the USAID Bureau for Resilience and Food Security assessing the Digital Agriculture Ecosystem in Mozambique. The assessment is being led by Athena Infonomics (the organisation I am working for), in partnership with DAI. To do this, we are speaking with a range of external stakeholder who xxx
- This interview will last for approx. XX min and will remain confidential. Comments will not be attributed to individual stakeholders, unless requested. We would normally record the interview for reporting purposes.

The recording would only be used by Athena Infonomics for reporting purposes. **Do you consent to have this interview recorded?**

— Do you consent to have your name and organisation referenced in this assessment?

I. General

- Can you please describe your (the person) role in the organization?
- How do you describe the core mandate of your organization in the agricultural sector in Mozambique?
- How long has your organization operated in the market?
- In what geographic areas does it operate? Does it work at the province or district level?
-

II. Programming Overview

- **Do you** disseminate information on relevant innovations and information from Digital Agri-Techs to the farmers? If, so how? If not, why not?
- What initiatives/programs have been put in place by your organization to encourage the use of technology in farming by its members (farmers)?
- What role do you see your organization playing in the Digital Agri-Tech ecosystem of the country in the next 5 years?

III. Digital in Agriculture

- What are some of the key challenges in the agriculture sector in Mozambique which affect agricultural technology innovations?
- In your perspective, what is the existing supply of technology solutions for these challenges? In other words, is the demand for technology innovations being met? How does this supply vary within the country?
- How has the sector evolved in the last 5 years in terms of Digital Agri-Tech in Mozambique?
 - a. What measures can be put in place to ensure that Digital Agri-Tech innovations in Mozambique become scalable and sustainable?
- What is your perception of the quality of the pipeline for Digital Agri-Tech innovations in Mozambique?

IV. Information Needs

- What type of agriculture data/information do you try to obtain?
- Where do you access this information from?
 - Community radio/television
 - Internet
 - Newspaper
 - Social media
 - Other - please specify
- What languages is the data available in and how important is it for you?
- Is the data used by your organization accessible for free?

V. Investment in Digital

- What role do you play in supporting Digital Agri-Tech innovations?
 - a. How and in what do you invest or provide support?
- What influences the choice of what you invest in?
- How do you identify/source Digital Agri-Techs for investment/support?
- How do you monitor the use of the funds/ investments that you give/ invest to Digital Agri-Tech innovators?
- What exit opportunities would you like to see in the Digital Agri-Tech innovation ecosystem?
- What are some of the challenges that you face in investing in Digital Agri-Techs?
 - a. How have you overcome such challenges?

VI. Experience Implementing Digital

- What are the primary barriers to using digital technologies in agriculture?
 - Cost?
 - Digital literacy?
 - Network connectivity?
 - Preferences?
 - Migrating systems and processes?
- Can you tell us about your experience integrating any digital tools/solutions/services within your programming on agriculture, food security, nutrition, resilience?
- **If some digital integration:** Please describe the program, corresponding tools/solutions/services, who did the tool target (project staff, farmers, admin, etc), type of service provider partnerships.
- What are your key motivations and objectives for using these digital tools/solutions?
- Why did you select this service provider to partner with?
- How have these impacted the end user/program participants?
- What have been the successful outcomes?
- What are the challenges in Mozambique specifically to expanding uptake of digital solutions within agriculture?

VII. Opportunities for Digital

- What are some of the primary challenges your organization faces? What takes up more of your time?
 - Flow of information and processes?
 - Communications internally?
 - Accounting / inventory?
- Which new services in the market would you like to see ?

Infrastructure

- What are the main gaps in basic infrastructure that are affecting the advancement of agri-technology to the farmers?
- What recommendations do you have for strengthening infrastructure for Digital Agri-Techs? Of these recommendations, do you see your organization playing a role?
- How would you rate the mobile network coverage, reliability and speed in rural areas where the farmers are?
- How many of your beneficiaries (farmers) own a smartphone/phone/no phone? Do you own a smartphone? (estimated percentage)?

Affordability

- How affordable are mobile devices and data for your beneficiaries?

Digital Literacy

- How easy is it for your organization to apply ICT acquired skills at your organizational level? If limited to low - ask why?
- What types of things do your beneficiaries usually use their phones for (WhatsApp, SMS, mobile cash services, calls, etc.)?
- Are your beneficiaries aware of available digital ag tools? If yes, which ones do you use and why?
- How frequently do you use them?
- Do they need/seek any training to use those apps?

Digital Divide

- How do mobile phone ownership and usage differ between men and women in the communities you work with?

- Does your organization support the digital inclusion of women? If yes, how? If not, why not?
- What is their average education level (primary school, secondary, etc.)?
- How do you think ICT initiatives can further support women within your organization?
- What impact might increased digitalization have on gender inequality, particularly at the farmer level?
- Does your organization work with young people? If yes, where do they usually work and why?
- What incentives could lead to young people being more involved in ag?
- Do you think technology and ICT tools can help them be more involved?

Data

- What does your organization do to protect the security of your computer systems, data, and information about members?

Regulations

- What are some of the regulatory/policy initiatives that make it favourable for you to operate in the Digital Agri-Tech ecosystem?
- What are some of the regulatory/policy level challenges that you face?
- What do you see as the main opportunities for strengthening the policies and regulations affecting the Digital Agri-Tech ecosystem?

Government Services

- What digital solutions does the government offer farmers/agriculture actors, if any?
- Does the government provide any support to your organization to enable you to promote digital solutions within agriculture?

Digital Financial Services

- Are you aware of mobile money in [country]? Do you use it in your programming? Why or why not?

Tech Startup Space

- Are there quality networking opportunities for digital ag startups (for example, events, conferences, networking groups) to raise awareness to organizations like yours of available tools?
- How do agriculture actors support digital ag startups currently? How can they better support them in the future?

Role of Finance in Enabling Digital Innovations

- What role can financing play in promoting an innovation culture in agriculture, especially among youth and women?
- What are the innovative financing mechanisms for improving access to finance to Digital Agri-Techs? How accessible are they in the country?
- What challenges or constraints have you encountered in financing and deploying capital into Digital Agri-Tech innovations?
- What are some of the recommendations, implementing which, can help support your investment processes for Digital Agri-Techs ecosystem?

Conclusion:

- Any final thoughts or advice you would like to share with USAID?
- Can you refer us to any individuals, institutions or literatures for further interviews/inquiry?