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DIGITAL AGRICULTURAL ECOSYSTEM IN MALI

Written in partnership with USAID, DAI, Development Gateway, and Athena Infonomics.

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LIST OF ACRONYMS

AGETIC	Agence des Technologies de l'Information et de la Communication
AOPP	Association des Organisations Professionnelles Paysannes
ARMTP	Autorité Malienne de Régulation des Télécommunications et des Postes
CALM	Country Assessment Landscape Methodology
CNOP	Coopérative Nationale des Organisations Paysannes
CSA	Commissariat à la Sécurité Alimentaire
DG	Development Gateway
ECOWAS	Economic Community Of West African States
EIDB	ECOWAS Bank for Investment and Development
FAO	Food and Agriculture Organization
GDP	Gross domestic product
GIS	Geographic information system
GSMA	Global System for Mobile Communications Association
ICT	Information and communication technologies
IVR	Interactive voice response
IER	Institut d'Economie Rurale
IOT	Internet of Things
KII	Key informant interview
LWR	Lutheran World Relief
NDVI	Normalized difference vegetation index
NPK	Nitrogen/phosphorus/potassium
MSA	Mali Startup Association
SMS	Short message services
SMTD	Société Malienne de Télécommunications et de Distribution
SWOT	Strengths, weaknesses, opportunities, threats
USSD	Unstructured supplementary service data
WAFB	West African Development Bank

EXECUTIVE SUMMARY

Development Gateway (DG) and Athena Infonomics conducted an assessment of the digital agricultural ecosystem in Mali between September 2021 and January 2022. The goal was to broaden USAID/Mali's awareness of current digital products and to promote the potential for ICT initiatives as part of USAID/Mali's programming efforts to improve agricultural productivity and to leverage the agricultural sector as a driver of national economic development.

The assessment was conducted using DG's Custom Assessment Landscape Methodology (CALM.) The CALM methodology uses a combination of desktop research and mixed data collection methods, including key informant interviews (KIIs,) surveys, and data analysis, to understand the context, collect user needs, and identify the links—or missing links—between key stakeholders in a specific sector.

In Mali, the CALM methodology helped the assessment team understand the national context, policy and institutional framework, and the country's readiness and ability to promote ICT tools, key digital infrastructure limits and identify agriculture sector stakeholder's priorities that ICT could address. A total of 40 interviews were conducted in a three-month period. Questionnaires were developed for each actor profile and used during the interviews. The interviews supported a review of ICT implementations, highlighting programming challenges, best practices, and lessons learned. The comprehensive list of interviewees is available in Annex 1.

Key Findings

1. The Malian agricultural sector has not reached its growth potential, predominantly related to lingering issues of smallholder farming, including limited access to credit opportunities and low resilience, especially in response to the effects of climate change. Mali's agriculture sector focuses on cotton and cereal production while other agricultural products are underexploited. The assessment revealed that farmers' access to market opportunities is still narrow and agro-business activities are exacerbated by the country's current unstable political context.

2. Increasingly, development actors tend to recommend ICT technologies and solutions as a path to improve various international sustainable development targets, including in the agricultural sector.[1] However, Mali's digital readiness is impaired by the overall technical infrastructure shortcomings and outdated regulatory and institutional frameworks. Policies and regulations governing the operations of the various institutions involved in the ICT sector lack clarity in their

1. Technical Centre for Agricultural and Rural Cooperation. (2019). The Digitalisation Of African Agriculture Report, 2018–2019 Executive Summary. https://cgspace.cgiar.org/bitstream/handle/10568/103198/Executive%20Summary%20V4.5%20ONLINE.pdf

mandates and responsibilities leading to siloed and uncoordinated efforts with limited impact. Mali's national electricity access rate is estimated to be less than 40 percent in urban areas and less than 20 percent in rural areas.[2] The country's mobile coverage index was close to 57 percent in 2019. Orange Mali, the leading mobile operator with an estimated 54.8 percent of the market share in 2018, explained that 4G technology has been deployed in urban areas, while rural areas are still using 2G. These factors limit digital awareness and become obstacles to digital literacy when combined with the low literacy rates of Mali's adult population – estimated in 2021 as 46.2 percent for men and 25.7 percent for women.[3]

3. Despite these findings, the assessment revealed tangible ICT opportunities, which can strengthen the agricultural sector. At the institutional level, the government is committed to reviewing and updating the ICT regulatory framework, adding new regulations on cybersecurity, cyber crime, and personal data security. Orange Mali shared their plan to extend 4G/5G coverage to the entire country, emphasizing the government's liability in securing their equipment prior to improving their mobile network performance, especially in the northern part of the country that currently presents the highest security risks.

4. Farmers expressed the need for a more resilient agriculture sector through facilitated access to new agricultural technologies, formal credit opportunities, and stable markets. Current ICT implementations aim to share crop and livestock reference prices to harmonize farmers profit margins across the country, provide advisory services, and broadcast weather data to support farmers in improving a farm's overall health and productivity. Other activities try to drive ICT product success by raising awareness and improving data literacy in local communities, especially targeting young people, strengthening their capacity, and getting them more involved in the agricultural sector. Emerging ICT solutions introduce new concepts such as savings, insurance, and farm management and aim to improve market linkages between potential buyers and sellers.

5. The success and sustainability of digital products rely on the ability of those products to adjust to the local context and flexibility to respond to circumstantial factors and risks. The suggested recommendations therefore build on the strengths and the opportunities of the Malian ecosystem and include pathways to overcome potential obstacles to greater ICT uptake in the agricultural sector. The recommendations include:

- **improving coordination** around ICT initiatives in the agricultural sector;
- **implementing sustainable ICT products** to respond to stakeholder needs and promote complementary products;
- **articulating mutual accountability mechanisms** by empowering local implementing partners and communities; and
- **using ICT technologies** to support the different segments of the value chain and lower investment risks.

2. International Trade Association. (Oct. 18, 2021). "Mali - Country Commercial Guide: Market Overview." https://www.trade.gov/country-commercial-guides/mali-market-overview
3. DataReportal. (Feb. 12, 2021). "Digital 2021: Mali." https://datareportal.com/reports/digital-2021-mali

NATIONAL CONTEXT

Agriculture in Mali

Agriculture and agro-pastoralism are important pillars of the Malian economy. Estimates from the World Bank suggest that agriculture and fishing contributed to over 36 percent of Mali's GDP in 2020.[4] Over 80 percent of Mali's population is engaged in agriculture and associated activities, making this sector crucial for human and economic development.[5] Despite the magnitude of the agricultural sector, food insecurity remains rampant in Mali. Statistics from 2016 indicate that nearly 25 percent of of families were food insecure, while nearly 40 percent of children under the age of five suffered from malnutrition.[6]

While Mali has significant agricultural potential, the agriculture sector faces several constraints:

Lack of Innovation

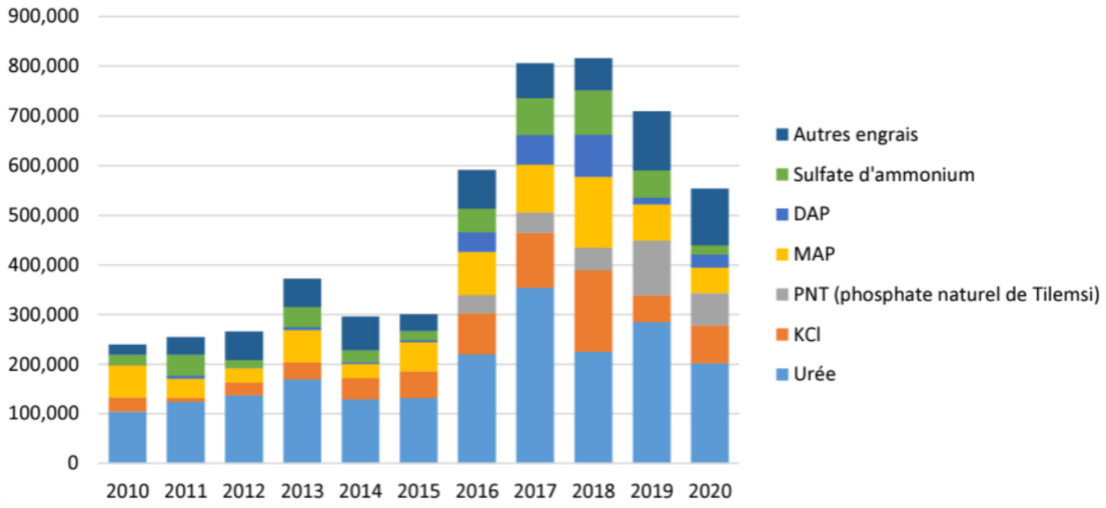
The Food and Agriculture Organization (FAO) suggests that "the lack of innovative technologies" is one of the main challenges to the agriculture sector in Mali.[7] The agriculture sector would greatly benefit from improved seeds and inputs to improve soil conditions. Additionally, crop storage facilities are archaic and proper crop handling and logistics are lacking. Figures from 2017 suggest that nearly 17 percent of maize, nearly 12 percent of sorghum, 11 percent of rice crops, and 8 percent of millet were lost in post-harvesting processes such as drying, handling operations, farm storage, transport, and market storage.[8]

Farmers and farmers' associations interviewed agreed with the FAO assessment. They believe that modernizing agriculture with proper equipment, improved seeds and inputs, and innovative techniques can respond to climate change effects and create more resilient agriculture.

The following figure, extracted from the *2020 Mali Fertilizer Statistics Validation Workshop Report*, shows the continued heavy usage of urea rather than nitrogen/phosphorus/potassium (NPK) blended fertilizers that are known to replenish lost soil nutrients and enhance crop productivity and soil health.

4. World Bank, Data. (2020). "Agriculture, Forestry, and Fishing value added (% GDP) - Mali." https://data.worldbank.org/indicator/NV.AGR.TOTL.ZS?locations=ML
5. Food and Agriculture Organization. (July 2017) *Country Fact Sheet on Food and Agriculture Policy Trends*. https://www.fao.org/3/i7617e/i7617e.pdf
6. USAID. (2018). *Mali: In-depth Assessment of Extension and Advisory Services*. https://www.digitalgreen.org/wp-content/uploads/2017/09/DLEC-Mali-In-depth-Assessment-Extension-Final.pdf
7. Food and Agriculture Organization. (July 2017) *Country Fact Sheet on Food and Agriculture Policy Trends*. https://www.fao.org/3/i7617e/i7617e.pdf
8. The African Postharvest Losses Information System. (2021). "Estimated Postharvest Losses (%) 2003 - 2021." http://archive.aphlis.net/?form=losses_estimates&co_id=31&c_id=324

Figure 1: Evolution of Apparent Consumption of Fertilizer in Mali from 2019 to 2020 (in Tons of Product)



Mali's mean temperature has increased by 0.7°C since 1960.[9] Rainfall has been decreasing steadily since the 1990s, and future precipitation is projected to be more erratic.[10] These climate change effects cause the country to be vulnerable, especially given its dependency on rain-fed agriculture. Mali is a good candidate for the irrigation of cultivable land; USAID estimates that only 14 percent of irrigable, cultivable land is currently being irrigated.[11]

Limited Crops

The agricultural sector in Mali is heavily focused on cotton (700,000 tons produced in 2019)[12] and cereal production (maize, rice, sorghum, millet) that totaled 10,271 tons in 2020.[13] Other agricultural products – wheat and shea butter (a combined 81 tons in 2020)[14] remain under-exploited. The import/export of agricultural products remains limited with the exception of cotton. In 2020, cotton accounted for 6.7 percent of total Malian exports, which is the second largest export commodity after gold.[15]

Political Instability

Situational challenges linked to the current political instability prevent a fluid trade of goods and services within the country, causing the delay or cancellation of some supportive IT solutions and projects in the agricultural sector, especially in the northern and central regions. In January 2022, the Economic Community of West African States (ECOWAS)—with the exception of Guinea and Mauritania—imposed

9. World Bank, Climate Knowledge Portal. (2020). "Mali: Current Climate." https://climateknowledgeportal.worldbank.org/country/mali/climate-data-historical
10. Tarif, Kheira and Grand, Anab Ovidie. (July 8, 2021). "Climate change and violent conflict in Mali." ACCORD. https://reliefweb.int/report/mali/climate-change-and-violent-conflict-mali
11. USAID. (Mar. 4, 2022.) "Mali: Agriculture and Food Security." https://www.usaid.gov/mali/our-work/agriculture-and-food-security
12. The Economics of Land Degradation. (2020). *Cotton production and land degradation in Mali.* https://www.eld-initiative.org/fileadmin/Regreening_Africa_publications/Mali_Factsheet_ELD_ReGreening_Africa_EN_2020.pdf
13. Food and Agricultural Organization. (Nov. 2, 2021). "Country Briefs: Mali." *GIEWS - Global Information and Early Warning System*. https://www.fao.org/giews/countrybrief/country.jsp?code=MLI&lang=en
14. ibid.
15. ibid.

sanctions against Mali,[16] including closing their borders and suspending commercial and financial transactions between ECOWAS countries and Mali. The sanctions are intended to freeze Mali's government, public, and semi-public organization assets in the central ECOWAS banks and suspend all financial assistance and transactions to Mali by ECOWAS financing institutions, particularly ECOWAS Bank for Investment and Development (EIDB) and the West African Development Bank (WAFB). First necessity goods, however—including consumer food products, pharmaceutical products, medical materials and equipment, petroleum products, and electricity—are exempt from these sanctions.

Limited Access to Markets

Farmers, farmers' associations, and women's groups shared the challenges they face in gaining access to market prices and opportunities. There has been significant headway made in this area, though, as many current ICT initiatives aim to improve financial transparency by disclosing market prices to farmers' groups and associations and by connecting farmers directly to marketplaces.



KIIs with women's groups affirm that women are an intrinsic part of Malian agriculture.

Women mainly focus on horticulture and crop processing; their participation is estimated at 90 percent.[17] However, women farmers face constraints primarily related to the socio-cultural environment. Women do not own land in practice despite 1) "The Agricultural Land Act,"[18] which stipulates that 15 percent of state or local government land developments should be allocated to women's and youth groups and associations, and 2) "The Agricultural Orientation Law,"[19] which promotes equitable access to agricultural land resources and gives preferences to women, youth, and vulnerable groups in the allocation of plots in areas developed with public funds. Women inherit cultivable areas allocated by male farm managers. Those areas are often smaller in size, as they are shared among women's associations. In one example, a cooperative shared 20 hectares of land, only five of which are exploited for 480 women (i.e. an average of 0.05 hectares per woman compared to a potential of 0.2 hectares per woman). Women's groups further explained that the land they receive is often less fertile and that their insufficient knowledge, low literacy, and limited access to formal credit opportunities and improved inputs significantly limit their ability to improve their livelihoods. In addition, their daily household duties increase their isolation and reduce their agricultural potential and productivity.

16. Reuters. (Jan. 10, 2022). "West African nations sever links with Mali over election delay." CNN. https://edition.cnn.com/2022/01/10/africa/ecowas-sever-links-mali-intl/index.html
17. Sinai Béré, Women Group of Segou. (Dec. 20, 2021). Interview
18. President's office. (April 21, 2017). "Portant sur le Foncier Agricole." Journal Officiel de la République du Mali. https://www.droit-afrique.com/uploads/Mali-Loi-2017-01-foncier-agricole.pdf
19. Assemblée Nationale, République du Mali. (2006). "Portant Loi d'Orientation Agricole." https://nyeleni.org/IMG/pdf/loa_Mali.pdf

Mali's agricultural sector is vulnerable at every step of the value chain. The country's limited use of innovative agricultural technologies and techniques inhibits its production capacity and overall agricultural potential. The current security situation exacerbates an already fragile ecosystem and impacts import/export prices and other logistics related to the transportation and delivery of quality agricultural inputs. *The 2020 Africa Fertilizer Report* showed a decline in fertilizer usage due to high import prices and restricted access to some regions of the country. The latent risk of food insecurity becomes a priority as demographic projections show that Mali's population is expected to reach 43,585,532 inhabitants by 2050,[20] a 105 percent increase from the 2022 population.

Mali's Digital Context

Development actors often recommend ICT technologies and solutions as a path to improve various international sustainable development targets, including in the agricultural sector;[21] however, the success and the sustainability of ICT products largely depend on the conduciveness of the national framework, the technical infrastructure, and the capacity of end users to engage and improve ICT uptake. The assessment revealed some challenges in Mali's ecosystem that should be addressed for more impactful ICT efforts.

During the KIIs, government agencies and institutions involved in the Malian digital ecosystem expressed the need for a clear definition of their respective roles and responsibilities. Instead of complementary responsibilities and activities, institutions are sometimes in competition with one another, leading to uncoordinated efforts. For example, both the Agence des Technologies de l'Information et de la Communication (AGETIC) and the Société Malienne de Télécommunications et de Distribution (SMTD) have similar mandates to manage the government ICT infrastructure but are siloed endeavors. Furthermore, the financial resources to implement the government's digital strategy are executed by AGETIC but managed by the Agence du Fonds d'accès Universel, often causing unnecessary administrative delays.[22]

At the policy and strategy level, the ICT regulatory framework in Mali is outdated and does not account for recent institutional changes. The Ministry of Communication and Digital Economy stated that the government has initiated the review and harmonization of the various frameworks and legislation governing the ICT sector. The telecom regulator, Agence Malienne de Régulation des Télécommunications et des Postes (ARMTP), has also begun drafting documentation regulating cybersecurity, which will be submitted to the Council of Ministers in the near future. Laws and regulations governing cybersecurity[23] and cryptology[24] mechanisms have been published, including provisions

20. United Nations, Department of Economic and Social Affairs, Population Division. (June 17, 2019). *2019 Revision of World Population Prospects*. http://www.un.org/development/desa/publications/world-population-prospects-2019-highlights.html
21. Technical Centre for Agricultural and Rural Cooperation. (2019). *The Digitalisation Of African Agriculture Report, 2018–2019 Executive Summary*. https://cgspace.cgiar.org/bitstream/handle/10568/103198/Executive%20Summary%20V4.5%20ONLINE.pdf
22. Example: Société Malienne de Transmission et de la diffusion - SMTD; Agence de Gestion du Fonds d'Accès Universel – AGEFAU
23. Autorité Malienne de Régulation des Télécommunications/TIC et des Postes (Dec. 5, 2019). *Law No. 2019-056 on the repression of Cybercrime*.
24. Autorité Malienne de Régulation des Télécommunications/TIC et des Postes. (May 6, 2916). *Law No. 2016-011 on the rules applicable to the means, modalities, services and systems of cryptology in Mali*.

on personal data protection.[25] However, most actors in the ICT environment are either unaware of the existence of these laws or unfamiliar with their exact content, which causes some ICT implementers to use international security standard requirements in their activities instead.

The KIIs suggest that strong initiatives are undertaken at a high level but are rarely implemented in practice. Implementation seems to suffer from a low technical capacity of the institution's managerial staff. The government's willingness to improve the ecosystem should be articulated by recruiting adequate personnel with appropriate capacities and expertise to fill in managerial roles within the different institutions. For example, *The Plan Numérique Mali 2020*,[26] has failed to meet expectations. The scope was overly ambitious; its implementation suffered from insufficient financial, technical, and human resources as well as other difficulties induced by the socio-political context.

Other challenges reported at the institutional and organizational levels are related to the shortcomings in the overall technical infrastructure. The national electricity access rate in urban areas is estimated between 20 percent and 40 percent in rural areas.[27] KIIs revealed improper electrical wiring in office buildings and noted the absence of basic electrical equipment (generators, inverters, etc.) usually recommended for data centers and technical spaces hosting ICT equipment.

As far as mobile connectivity is concerned, Mali is disadvantaged by its landlocked geographical position, rendering it heavily dependent on neighboring countries for bandwidth. Without direct access to the sea and to submarine fiber optic cables, the country uses neighboring countries' networks, which leads to extra costs and makes it difficult for Mali to achieve the same bandwidth prices that can be achieved by coastal countries. The table below summarizes Mali's key mobile metrics compared to neighboring countries (2019).

25. Autorité de Protection des Données Personnelles. (May 21, 2013) *Law No. 2013-015 on the Protection of Personal Data in the Republic of Mali*
26. Ministere de l'Economie Numérique, de l'Information et de la Communication, Secretariat General. (May 21, 2015). *Politique nationale de développement de l'économie numérique*. https://en.unesco.org/creativity/sites/creativity/files/qpr/politique_nationale_de_development_de_l_economie_numerique.pdf
27. International Trade Association. (Oct. 18, 2021). "Mali - Country Commercial Guide: Market Overview." https://www.trade.gov/country-commercial-guides/mali-market-overview

Figure 2: Comparative Analysis by Mobile Index Score

2019

	Mali	Sénégal	Côte d'Ivoire	Burkina Faso	Guinéa
MOBILE INDEX SCORE	33.9	41.3	44	32.4	31.1
NETWORK COVERAGE	56.2	77.3	61.8	39.3	42.6
NETWORK PERFORMANCE	42.2	36.4	39.1	24.9	19
AFFORDABILITY	48	44.6	42	44.4	47.4
MOBILE OWNERSHIP	55	57.7	56.9	50.9	53.3

Source: Mobile index scores are computed by GSMA. The highest possible score for each component is 100.

Mali currently has a total of three mobile operators: Orange Mali, Moov/Malitel, and Telecel. Orange Mali is the leading mobile operator, with an estimated 12 million subscribers in 2020, representing an estimated 54.8 percent of the overall market share. Orange Mali is the only operator involved in all current agricultural ICT products and offers reduced cost unstructured supplementary service data (USSD),[28] short message (SMS,) and data access services to its subscribers.

Mali's mobile network has made notable progress since 2018. As illustrated in the figure below, Mali's mobile score index increased from 29.74 in 2018 to 33.9 in 2019, an approximate 14 percent increase. This increase is higher than the average country in sub-Saharan Africa, which showed a 3 percent increase for the same period.

28. AfricaFertilizer.org. (October 2021). "Mali: Market Comments." http://africafertilizer.org/mali/#tab-id-4

Figure 3: Mobile Index Scores Evolution



In 2020, Mali's Internet users were estimated at 5.74 million, representing 27.9% of Mali's total population; 78.9 percent of web traffic is registered through mobile phones.[29] Women still face difficulties in acquiring mobile phones, mainly due to their lower income levels. The GSMA estimates a gender inequality of 74 percent in affordability and a gender equality of 36.2 percent in consumer readiness,[30] defined as the estimate of awareness and skills needed to add value and use the Internet. KIIs with farmers' associations and women's groups reveal that most women linked to these groups do own a phone, of which about 50 percent are smartphones. Given their low literacy and education levels, the groups also indicated that women primarily use their mobile phones for voice calls or to send and receive voice notes via WhatsApp, an application that ICT implementers also use frequently to communicate with their field agents.

The security context also has an impact on the country's overall digital landscape. Government institutions and development partners shared that they are forced to limit their interventions to areas they can safely access. Orange Mali stated that their network only covers the Mopti region, as their equipment has been damaged in areas with high security risks. They also highlighted the government's responsibility to help secure Orange Mali infrastructure prior to extending their network coverage to areas with higher security risks.

29. DataReportal. (Feb. 12, 2021). "Digital 2021: Mali." https://datareportal.com/reports/digital-2021-mali
30. GSMA. (2019). "Mali | Detail and Analysis." *The GSMA Mobile Connectivity Index*. https://www.mobileconnectivityindex.com/#year=2019&zoneIsocode=MLI&analysisView=MLI



ICT IN AGRICULTURE LANDSCAPE

Current Solutions and Technologies

Several private sector, donor, and government-led programs have attempted to use ICT to solve challenges in Mali's agriculture sector. The table below summarizes information related to current ICT agricultural products under implementation in Mali, including limitations and challenges.

NOTE

The latter part of the table includes projects that are in the early stages of their implementation (less than 6 months). As such, the analysis is focused primarily on the proposed implementation approach and expected results, and information on user uptake challenges is not available.

Figure 4: Summary of Current Agricultural ICT Solutions

Solution Name (Inception Year)	Description	Technology	Services	Limitations	User Uptake Challenges	Implemented by	Donor Funding
Agribox (2020)	A private initiative that broadcasts agricultural product prices on local TV and radio stations in local languages	Radio/TV	Farmer information services[31]	Equipment purchase costs at the listener level	N/A	Agribox	No
Buy for Women (2021)	A digital platform that connects women farmers to information and buyers	Web-based platform	Digitally-enabled value chain integrators[32]	Heavily dependent on computer skills	N/A	UN Women/ AGETIC	UN Women
Garbal (2015-2017)	A service intended to locate surface water points; herbaceous biomass quantity and quality; and livestock density, pastures, and water points. A digital platform also promotes savings and facilitates market linkages with agro-dealers	GIS satellite imagery	Precision agriculture advisory[33] Digitally-enabled value chain integrators Savings	Challenging partnership with Orange Mali Limited satellite imagery resolution causing satellite data to be cross referenced with field data No extension plan for the project	Implemention is in the northern part of the country, causing insecurity issues.	SNV/IER/ Orange Mali	SNV/USAID

31. Services that provide general advisory information on agronomic best practices (e.g. growing, harvesting, post-harvest treatment, storage, inputs, and market prices) without tailoring the recommendations beyond national, value chain, or district levels.
32. Digitally-enabled value chain integrators are D4Ag solutions that use digital tools combined with either in-house or third-party human agents to link agricultural markets. At the core of these models is the ambition to capture value and generate impact for both smallholder farmers and agro-businesses by formalizing currently fragmented and informal value chains.
33. Precision agriculture advisory services represent recommendations tailored to individual and localized agro-climatic conditions (e.g. weather, soil, etc.), crop varieties, and the economic setting of the farm (e.g. input prices, market prices, and market distances).

Solution Name (Inception Year)	Description	Technology	Services	Limitations	User Uptake Challenges	Implemented by	Donor Funding
Mali Bétail (2010)	Livestock market information system available to farmers via website and through a dedicated server	SMS internet Radio	Precision agriculture advisory	Language barriers between OMA and University of Texas A&M, who mostly communicated in English Financial constraints and sustainability challenges	Farmers' illiteracy does not encourage them to access information through the server	University of Texas A&M/ OMA	USAID
MyAgro Connect (2012)	Mobile application for farmers to save and to use their savings to purchase seeds and inputs	SMS internet 3G/4G	Savings Participatory advisory[34]	Mobile money services limited to Orange subscribers Connectivity challenges	Low capacity level High illiteracy rate Commercial license linked to the number of subscribers	My Agro/ Orange Mali	USAID
Nyesigui (2016)	Weather data collection in communities	SMS internet 3G/4G	Precision agriculture advisory Participatory advisory	Limited to French and Bambara Limited to Segou and Sikasso regions	High illiteracy rate Low local capacities Initial farmer reluctance	Mali Météo	Helvetas

34. Participatory solutions feature tight feedback loops between content providers and end-users; greater levels of farmer interactivity with the solution (i.e. not just one-way information flows from experts to farmers); and possibly a role—direct or indirect—for farmers in creating or customizing advisory content. It includes peer-to-peer advisory solutions, which put individual farmers and agricultural experts into more central roles for content creation and dissemination.

Solution Name (Inception Year)	Description	Technology	Services	Limitations	User Uptake Challenges	Implemented by	Donor Funding
OKO Finance (2020)	A mobile application to secure the income of small agricultural producers by protecting their production from drought and flooding	SMS GIS	Insurance Participatory advisory	Service only applies to specific crops (corn, sorghum, millet, cotton, and sesame) Satellite imagery limited resolution	High illiteracy rate Difficulties for OKO to obtain a brokerage license	OKO Finances	--
Relief 2 (2014)	Early warning system and broadcasting of weather information	SMS IVR internet 3G/4G	Precision agriculture advisory Participatory advisory	Sustainability challenges for information access costs that are currently supported by the project budget	High turnover of relay agents in the field Poor satellite imagery quality Low local capacity High illiteracy rate	Lutheran World Relief	Lutheran World Relief
Sandji (2016)	SMS platform to provide daily weather data to subscribers	SMS	Precision agriculture advisory	Limited to Orange subscribers	Need for farmers to be located in their field High illiteracy rate	AMASSA Afrique Verte	USAID

Solution Name (Inception Year)	Description	Technology	Services	Limitations	User Uptake Challenges	Implemented by	Donor Funding
Senekala (2016)	Call center providing advisory services to farmers	IVR	Farmer information services	N/A	Limited awareness of the service in farming communities Low mobile network coverage and performance	AMASSA Afrique Verte	USAID
SIMAgri (2017)	Web to SMS platform providing agriculture wholesale and retail prices; sale and purchase offers; customizable alerts by actor profile; and broadcast messages	SMS internet 3G/4G	Precision agriculture advisory Digitally-enabled value chain integrators	Limited to Orange subscribers Current business model shows its limitations, as it still depends heavily on partner grants	High illiteracy rate Network coverage and performance Limited basic skills required to use smartphones	AMASSA Afrique Verte/CARE	USAID

35. 176 products are referenced in the platform; 73 markets are registered in the platform.

Early Implementation Projects

Activities	Description	Technology	Services	Limitations	User Uptake Challenges	Implemented by	Donor Funding
Sene Yiriwa Southern Zone (2021)	Provide producers with basic decision-making tools (Excel sheet) to help them create a database	GIS	Farm management Farmer information services	--	--	RTI	FtF/USAID
Sene Yiriwa Delta Zone (2021)	Aims to improve agricultural production management practices through integrated flooded/ irrigated production and drylands/rainfed production	Internet 3G/4G GIS	Farm management Participatory advisory	--	--	Devworks	FtF/USAID
Sugu Sud Kunkan (2021)	Website to facilitate direct linkages between producers and buyers	Internet 3G/4G	Digitally-enabled value chain integrators Farmer information services	The project focuses on market with high potentials, which may leave smaller markets out	--	CNFA	FtF/USAID
N/A (2021)	Facilitate the linkage between farmers and inputs/fertilizers and agro-dealers	--	Participatory advisory Digitally-enabled value chain integrators	--	--	Northwestern University	USAID Development Innovation Venture

Current Solutions, Technology Analysis, and Challenges

Almost a third of the current products aim to facilitate access to crops and livestock market prices, enabling farmers to sell their products at reference prices and potentially increasing their profit margins. Other products provide farmers with advisory services in local language, and early warning systems broadcast weather data. More recent implementations, including projects that are in early development stages, introduce new concepts such as insurance, savings, farm management, and market linkages to put sellers directly in contact with potential buyers.

However, ICT implementers face challenges that limit the uptake of these solutions, including:

High Illiteracy

Low literacy levels among farmers have been reported by 42 percent of the current ICT implementers, specifically those that do not support services in local languages. 2021 statistics suggest an overall literacy rate of 35.5 percent for adults, unevenly distributed among men (46.2 percent) and women (25.7 percent).[36]

Farmers' associations interviewed during this assessment—la Coopérative Nationale des Organisations Paysannes (CNOP) and l'Association des Organisations Professionnelles Paysannes (AOPP)—shared that most women in their associations have a primary level education. In the Segou region, the Bendya Cooperative shared that all women in their cooperative are uneducated, except one woman with a primary level education. Most women in the Sisin Bere cooperative (60 percent) have a secondary level education.



"Despite the support of UN/Women with a digital platform, no member of the cooperative has been able to access the online market since the platform was set up three years ago. Perhaps we need to improve the platform we have with online and Bambara (local language) computer training opportunities."

Yoruba Kokaïna, President, Badenya Women's Group

Illiteracy significantly impacts digital uptake and should be accounted for in all ICT implementations targeting farmers and women, in particular through: USSD, interactive voice response (IVR), and technologies to support services in local languages. Low literacy rates, specifically among women, can be overcome through the use of voice notes, other voice-activated applications, and the inclusion of more local language services.

Low Mobile Network Coverage and Performance in Mali's Rural Areas

Orange Mali indicated that most major urban centers (Sikasso, Segou, Bamako) are currently on 4G, while remote rural areas are still on 2G, limiting use of services that require mobile Internet technologies. SNV Garbal highlighted the significant delay experienced in securing a partnership with

36. DataReportal. (Feb. 12, 2021). "Digital 2021: Mali." https://datareportal.com/reports/digital-2021-mali

Orange Mali, an unprecedented situation that the operator explains by the absence of their coverage in the northern part of the country, which is in the Garbal zone of intervention. Orange's extension plan is to deploy 4G/5G technologies across the country—so long as the government is committed to securing the operator's infrastructure and investments, especially given the current political situation that limits the use of mobile Internet services in rural areas.

In 2020, 79.8 percent of web traffic originated from mobile phones compared to 16 percent from laptops and computers.[37] KIIs explained that mobile phones are more affordable than other end-user ICT equipment that is subject to prohibitively high sales taxes.

Low Capacity at the Local Level

Current ICT implementers repeatedly cited as a challenge the low technical capacity levels among their end users, data collection agents, and local relays. Therefore, initial basic digital skills training is a prerequisite, including how to use smartphones, tablets, and computers, which are often provided by project funds. Implementers working with field relay agents emphasized the need for continuous capacity-building activities to counteract low capacity levels.

At the software development level, solutions such as SIM Agri and Sugu Sud Kunkan are being developed by Baming, a West African company based in Burkina Faso. ICT implementers who have used the company's services confirmed Baming's capacity to develop software but clarified that the company could benefit from training opportunities in user interface designs and overall user experience of their solutions, thereby increasing their capacity and improving usability.

Limited Awareness and Digital Literacy

2021 statistics show an 18 percent increase in Internet use and a 23.5 percent increase in social media presence across the population of Mali.[38] Ongoing projects are trying to raise awareness and improve the digital literacy of young people generally. Projects also highlighted that young people visiting ICT centers tend to use the available equipment and the Internet for leisure activities—social media, video and music streaming, and web surfing—rather than to improve their knowledge of the agricultural sector.

ICT Product Solutions Limited to Orange Subscribers

All current ICT for agriculture implementations offering USSD, SMS, voice, and data services are engaged in a partnership with Orange Mali, which limits services to Orange Mali subscribers exclusively. ICT implementers indicated that increasing the number of subscribers will contribute to stabilizing their economic model and reduce their dependency on donor funding. One of the suggested solutions included partnering with the two other mobile operators—Malitel and Moov. However, Mali's 3G/4G/5G coverage

37. DataReportal. (Feb. 12, 2021). "Digital 2021: Mali." Slide 25. http://datareportal.com/reports/digital-2021-mali
38. DataReportal. (Feb. 12, 2021). "Digital 2021: Mali." Slide 18. http://datareportal.com/reports/digital-2021-mali

map[39] shows that these operators do not provide coverage beyond the Mopti area, which is less coverage than Orange Mali provides. In addition, Moov (Telecel) only offers services in the Bamako and Kaye regions. Securing a partnership with the two other operators may make a slight difference in the Bamako greater area, but it would not make a significant difference in rural zones.

ICT implementations also face cross-cutting challenges that impact a solution's use over time, including irrelevance, limited financial resources, and insufficient level of political will and ownership. The table below highlights three efforts that faced post-implementation challenges.

Figure 5: Discontinued ICT Initiatives

Solution Name	Expected Results	Current Status	Challenge
Mali Bétal	An ICT solution resulting from a joint partnership with the Office Malien de l'Agriculture (OMA) and Texas A&M	The website is offline due to the expiry of the domain name www.malinetail.net purchased during project implementation	Limited financial resources to renew and maintain the domain name
Stars	A project using drone technology and satellite imagery to define farm boundaries	Canceled	Low local participation Imagery results led to more conflicts between landowners
Sentinel	A data collection server implemented to collect higher quality agricultural statistics. Data collected was centralized in a server – purchased through the project and hosted at the Institut d'Economie Rurale (IER)	Canceled	It became difficult for the IER to maintain the server over time and to guarantee the stability and availability of the overall IT infrastructure, including electricity and Internet connectivity

39. nPerf. (n.d.). "Telecel Mobile 3G/4G/5G coverage map, Mali." https://www.nperf.com/en/map/ML/-/220733.Telecel-Mobile/signal/?ll=12.211180191503997

ICT Enablers

The assessment revealed that some ICT enablers are currently working to raise ICT awareness, improve digital literacy, and increase uptake within communities. Many specifically target youth.

Digital Literacy Enablers

A handful of projects, such as Jinov and Helvetas, aim to promote ICT awareness and use of existing ICT solutions—including Senekala, Sandji, OKO Finance, MyAgro, Garbal, and SIMAgri—among farming communities. Jinov implements community-based technical centers equipped with computers and an Internet connection to provide basic computer skills, raise awareness about currently available solutions, and promote the use of the Internet to access agricultural best practices and tutorials.



"The center provided by the project JINOV offers us the possibility of accessing training modules visually and in local languages. We can download guides (in videos or photos) on the topics we are interested in [and] ask other members of the center for advice … Members of the center and the association who master a transformation process film the production process and put it online to serve other members."
Awa Diakité, Treasurer, SinSin Béré Women's Group

The Helvetas project is implemented in Sikasso, Mopti, and Gao. It allows young people to receive training on a number of applications of interest to farmers' organizations: OKO Finance, Senekela, Garbal, and Sandji. Within this project, young people are trained in service provision activities—installation, repair, and maintenance of solar panels—to generate income for themselves. Young relay agents are motivated by the income they earn to continue providing services and to reside locally.

The sample usage statistics summarized in the table below denote the growing interest of farmers in ICT solutions, which is encouraging for future ICT implementations.

Figure 6: Usage Statistics

Solution Name	Initial Estimates	Current Statistics	Gender Marker[40]
Nyesigui	15,000 farmers	47,000 farmers	32,000 women
OKO Finances	1,800 farmers	10,800 farmers	2,052 women
SIM AGRI	4,662 subscribers	7,952 subscribers	N/A
My Agro	Unknown	66,000 farmers	N/A
Core 2 Resilience	Unknown	17,928 beneficiaries	6,755 women

40. Gender markers indicate the extent to which gender-equitable considerations were made in the design and implementation of a project. These markers facilitate monitoring and analysis of policy and program commitments to gender equality. See: https://developmentgateway.org/blog/genderdatapt1/

Community Enablers

Current ICT initiatives that propose precision agriculture advisory services often employ data collection agents in the field. The proposed participatory advisory services benefit from stronger community engagement, starting from understanding farmers' needs to encouraging and collecting end-user feedback to improve the solution and its associated services. LWR focuses on early-warning systems and works with the University of Maryland to collect satellite images and with the Commissariat à la Sécurité Alimentaire (CSA) to process the data collected and to prepare translated newsletters that are broadcasted by Viamo in local languages. The project is implemented in 59 target villages. There are two relays per village in charge of the rainfall survey (one rain gauge per village); 20 other relays are in charge of monitoring the state of crops three times per year.

Using field agents has multi-fold benefits, including: the ability to overcome internal travel restrictions resulting from Mali's current security situation, overcoming barriers related to language and high illiteracy rates, and strengthening and empowering local communities to engage with ICT.

Technology Enablers

The *2019 GSMA: The State of Mobile Internet Connectivity* showed that less than 47 percent of the population of sub-Saharan Africa uses the Internet due to a lack of awareness, illiteracy, and/or the belief that ICT-related products are irrelevant to them. The Mali Startup Association (MSA) was created in 2020 to promote the use of ICT solutions in a variety of sectors—including agriculture and health. MSA is an association of young Malian developers. MSA already uses advanced technologies such as normalized difference egetation index (NDVI) images and has developed USSD services in local languages, some of which are summarized in the following text box.

Figure 7: Examples of MSA Current ICT Innovations

Solution Name	Description	Status	Implementer
Hadari	Hadari: automatic irrigation system using Internet of Things (IoT) sensors and a mobile application	Prototype developed and implementation ready	Boubacar Sangho Sene Global Business Technologie
Kodol	Kodol is a smart neckband solution that collects information on the health of livestock. The collar is coupled with an application allowing the farmer to receive real-time information on his animals as well as alerts.	Prototype phase	Abdoulaye Sall
Econserv	Packaging-As-a-Service Project: smallholder farmers and traders can use the Econserv application and SMS service to locate the nearest mobile cold storage and drying unit or in different markets. Through the use of mobile payments, cash, or subscription, farmers can pay for Econserv's storage service at affordable rates	Project conception phase	Abdoulaye Souaré

ENABLING ICT IN THE AGRICULTURE SECTOR IN MALI

The assessment findings guided the SWOT analysis of the digital agriculture ecosystem in Mali as illustrated in the figure below.

Figure 8: SWOT Analysis of Digital Sector in Mali

Strengths

Previous studies and initiatives provide relevant insight on lessons learned

Regional ICT expertise in the West Africa Region to reduce language barriers and IT maintenance cost over time

Current and future projects focus on different steps of the value chain

Weaknesses

Unfavorable IT general infrastructure

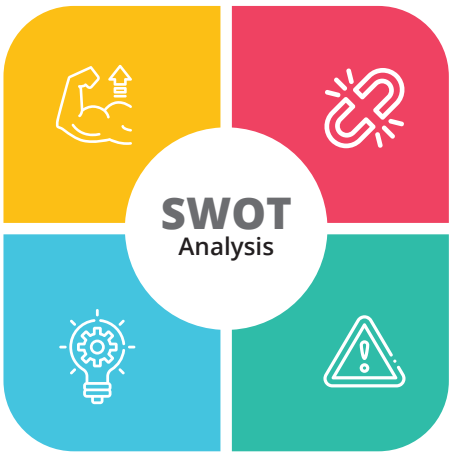
Limited local technical capacities

High illiteracy rates

Siloed initiatives

Lack of R&D incubators

Limited participation of mobile operators other than Orange Mali



Opportunities

Beneficiaries expressed needs

Presence of startup associations

Growing interest from private companies to support local ICT organizations

Prospect for women and youth to work as relay agents within their communities

Threats

Political instability

Obsolete and incoherent institutional framework to support ICT initiatives

Fragile public institutions

The lists of "weaknesses" and "threats" summarize current and potential challenges, while "strengths" refers to the current ICT enablers. The "opportunities" are based on needs expressed by stakeholders, priorities of key players, and recommendations to allow for greater ICT uptake in the sector.

Government Agencies and Institutions

All surveyed government agencies believe that ICT efforts should build on existing platforms and promote synergy and interoperability between actors. Well aware of the national context, the government agencies advise relying more on organizations than on individual farmers to establish a collective responsibility. ICT efforts should be overseen by competent partners for coordination, implementation, and support and as much as possible, involve local organizations in all phases of the project from design and implementation to monitoring and evaluation.

The Ministry of Communications and Digital Economy plans to encourage locally developed solutions and to legislate the startup sector, emphasizing the need for this new sector to be supported financially. The Ministry also expressed the need to use satellite solutions rather than fiber optics to cover the northern part of Mali, as it is the least accessible part of the country.

ICT Implementers

Some implementers expressed the importance of gaining access to data from previous initiatives, especially when they are funded by the same donor. From this data, implementers can learn more about past experiences, including lessons learned, best practices, and challenges that could potentially become obstacles to the implementation of new projects.

Farmers and Farmers' Associations

The needs of farmers and farmers' associations include more robust and resilient agriculture in response to adverse weather conditions resulting from climate change. Their priorities are directly linked to current agricultural challenges, including limited access to seeds, modern machinery, and other inputs as well as as limited access to formal and/or low-risk credit opportunities. Improved access to agricultural technologies should be accompanied by best practices in capacity-building activities and appropriate training modules to ensure proper application at the field level.

A few best practices have been identified in current ICT implementations, including those in the early implementation phase:



Offline Application

Example: MyAgro Connect offline application – To overcome mobile Internet instability in rural areas, the offline functionality of MyAgro Connect allows users to enter data even without any Internet connectivity. Internet connectivity is, however, required for synchronization.



Implemented Close to the Community

Example: Community input fairs (Northwestern University) – Input fairs are organized within the community to collect women farmers' needs and demands.



Youth Income Generating Activities

Example: Nyesigui-Helvetas – Young people have been trained to provide installation, repair, and maintenance of solar panels in their communities.

Aside from Garbal, most ICT implementers shared their plans to extend their solutions to other regions and, where applicable, to other crops.

RECOMMENDATIONS

The needs identified above provide a useful platform to structure and design impactful ICT efforts. While Mali's agricultural context, digital landscape, and current political fragility inhibit ICT uptake, the efforts addressing different aspects of the value chain—if working synergistically—can lead to better outcomes for stakeholders.

The following recommendations build on identified strengths and opportunities to engage in ICT solutions that are sustainable over time, starting with coordinated efforts supported by a collaborative and consultative framework. At the user level, recommendations aim to promote the implementation of ICT products that are relevant to users and affordable and flexible enough to adapt to Mali's context. Finally, recommendations for improved ICT product uptake build on mutual accountability principles and advocate for local partnerships to further support ICT initiatives along the agricultural value chain, identifying opportunities to increase private sector participation and to lower investment risks for all stakeholders.

At The Policy Level

1. Convene a multi-stakeholder group to coordinate ICT efforts. In an effort to respond to the many siloed initiatives in this sector, it is important to establish a multi-stakeholder digital working group. The group could also include a powerful knowledge-sharing platform where all stakeholders share their lessons learned and best practices to inform future implementations and avoid duplication of efforts. Aside from development partners and national institutions, representation in the stakeholder group could be extended to members of women's groups, farmers' associations, and the Mali Startup Association.

The multi-stakeholder group could invest in an ICT platform that embeds a geographical information service (GIS) platform to display ongoing efforts and projects in Mali's agricultural sector. The map can be enhanced with underlying indicator layers that can be tracked and monitored to measure project impact in all implementation areas. The GIS map could then be used as a decision-making tool to help identify priorities, share goals, avoid duplication, and provide partners with tailored support to respond to the multiple challenges of the current ecosystem.

USAID/Mali Role: **Leading**

USAID/Mali can bring together the relevant stakeholders and lead a multi-stakeholder digital working group based on similar activities implemented in other USAID missions. For example, the Sahel Regional Mission supported a digital working group[41] and a multi-stakeholder coordinating group on mobile money.[42]

41. USAID. (n.d.). "Digital Ecosystem Fund 2020 Activities." *USAID Digital Strategy 2020-2024*. https://www.usaid.gov/sites/default/files/documents/DEF-Factsheet.pdf
42. USAID. (May 2016). *Mobile Money Consultative Group Overview*. https://www.marketlinks.org/sites/default/files/resource/files/MMCG_overview_May2016.pdf



USAID/Mali could play a role in convening relevant stakeholders as part of the multi-stakeholder digital working group. Read more about USAID's past experience with convening working groups:

- The Mobile Money Consultative Group in Bangladesh
- The Digital Working Group in the Sahel Region

2. Develop a database to centralize key project information. The multi-stakeholder group should advocate for the development of an online central database that would be available to all ICT implementation partners. The database would provide access to critical information on past and current investments in ICT and would cover all project phases, including planning, implementation, and closing and should include the project's expected results, actual results, challenges, lessons learned, and best practices, along with other relevant datasets as appropriate. This central database would be the go-to source for any implementer wishing to get more information on a specific agricultural sub-sector, region, or for a specific target group such as women or youth.

USAID/Mali Role: **Leading**

This database should be populated by ICT implementers or partners. USAID and the multi-stakeholder group can develop templates to be completed and uploaded in an online database that will be the go-to source for baseline information.

At The User Level

3. Implement ICT solutions that are adaptable to the context. The Mali context analysis highlighted key challenges that ICT solutions should address to be sustainable, including the following difficulties that can limit user uptake: high illiteracy rates, low digital literacy, low technical capacity, and limitations imposed by weak infrastructure and mobile network.

4. Implement ICT solutions that are relevant to the user's needs and priorities. ICT implementations should begin with a collection of end-user data needs and priorities that can be combined with a partner's strategic objectives. Collecting end-user feedback about their needs is also an opportunity to learn about cross-cutting challenges, which could be addressed through project activities. USAID's Implementing Partners (IPs) may need to support the providers of relevant solutions to better understand the needs of their target users and to customize their solution accordingly.

5. Implement ICT solutions that are affordable in the medium and long-term. ICT implementations tend to fail because the financial resources required to maintain the product over time are unavailable. USAID/Mali should encourage its IPs to identify existing ICT solutions that can be used to meet user needs and that have viable business models enabling them to continue beyond engagement with USAID activities (see more in recommendation 6). In instances where USAID's IPs are developing a new ICT solution, which should generally be in rare and essential circumstances, USAID/Mali should strongly encourage the implementers to make use of open-source software where possible to reduce dependency on single vendors and eliminate long-term licensing fees.

USAID/Mali Role: **Leading**

Adaptability – In instances where USAID supports ICT solutions development, USAID/Mali should suggest that their ICT implementers:

- include USSD and IVR technologies in the envisioned solution,
- opt for solutions that operate in low-bandwidth environments, and
- include an offline functionality to reduce Internet dependency.

For more general support, USAID/Mali should suggest that their IPs plan for a significant capacity-building component, including developing online tutorials to support refresher training—especially given the infrastructure challenges and travel restrictions—and where applicable, supporting the use of local languages.

Relevance – USAID/Mali should ask its implementers to conduct a feasibility study prior to each ICT implementation. These studies should present expressed end-user needs, potential challenges (and their associated mitigation measures), high-level training plans for the local workforce, and needed end-user equipment. These feasibility studies could be further enriched with multi-stakeholder data sets compiled for each ICT implementer. The desired result is to implement an ICT solution that responds to end-user needs, while building sustainability by strengthening the local human capital and local infrastructure.

Affordability – USAID/Mali should recommend that its implementers give preference to local technical capacity or search within the West Africa region for the appropriate expertise, thereby reducing the challenges related to language barriers and significant maintenance costs if services are procured internationally.

USAID/Mali should also advise its partners to privilege products where prices are set at an initial fixed rate rather than where prices increase with the total number of subscribers. (An example would be a product where the price is set at $5 for the first 10 users but increased by $10 for every additional 20 users.)

6. Implement ICT solutions that are sustainable. Adaptability, affordability, and relevance are key sustainability factors for ICT implementations. For projects looking to deliver a new ICT tool, greater sustainability is achieved when the implementation aims to promote local ownership and mutual accountability. For initiatives looking to support an existing product, sustainability can be achieved by supporting the implementation of a strong business model that is capable of generating recurrent financing to sustain the initiative over time.

USAID/Mali Role: **Advisory**

Accountability mechanisms should be articulated from the early stages of a project by identifying the short-term activities, which can be funded by the project, and longer-term activities, which should fall under the local partner's responsibility. This approach should be clearly articulated through sustainability plans developed from the start of the activity. Jointly setting clear guidelines early in project implementations and getting users progressively accustomed to the role they play in maintaining implementation over time will help avoid unsuccessful initiatives that are heavily dependent on donor funding and involvement.

One recommendation is to separate short-term activities—including equipment purchase and overall infrastructure support—from long-term activities that require external funding even after the project ends. For initiatives that support providers with an existing solution, USAID/Mali should recommend a local benchmarking study to ensure that the selected local partners have a solid business model and the technical, human, and financial resources required to successfully maintain the solution over time. Short-term activities that could be funded might include initial licensing fees and capacity-strengthening activities. Long-term activities might include license renewal fees, refresher trainings, and business development to reach the expected results and expand outreach.

Partnerships

7. Strengthen strategic partnerships. Although the assessment did not reveal a specific incubator/accelerator program or organization, the Mali Startup Association (MSA) seems to have the basic expertise required to support ICT products and implementations. MSA was formed by a group of software developers already using technologies to support sustainable development efforts, including in the agriculture sector. MSA expressed some challenges related to lack of funding and access to end-user equipment.

USAID/Mali Role: **Advisory**

Provided that MSA's advertised expertise is confirmed, USAID/Mali could support MSA members in advanced ICT training such as exchange studies or immersion programs. With the appropriate support, MSA can be a strategic partner that brings the comparative advantages of knowing the sector and its challenges and acts as a link between farmers, agro-business companies, and government institutions.

8. Support the private sector. Agro-business dealers are interested in market trends and demands to help their overall business model and selling strategies. This is especially true of companies selling improved seeds and other inputs in response to climate change in countries with high agricultural potential. The financial institutions still classify the agricultural sector as high risk, which explains the difficulties farmers and farmers' associations experience when trying to access credit.

USAID/Mali Role: **Enabler**

The private sector can be involved in two ways: 1) agro-business dealers looking for high potential markets and 2) private financial institutions facilitating access to credit. Extending partnership alliances to the private sector can help address the fragility of public sector agencies and institutions due to their limited financial, technical, and human resources.

9. Explore ways to lower agricultural investment risks. An example model by agCelerant,[43] a research and development initiative with ICRISat and Manobi based on satellite imagery solutions combined with field data to reduce the investment risks, is illustrated in the figure below.

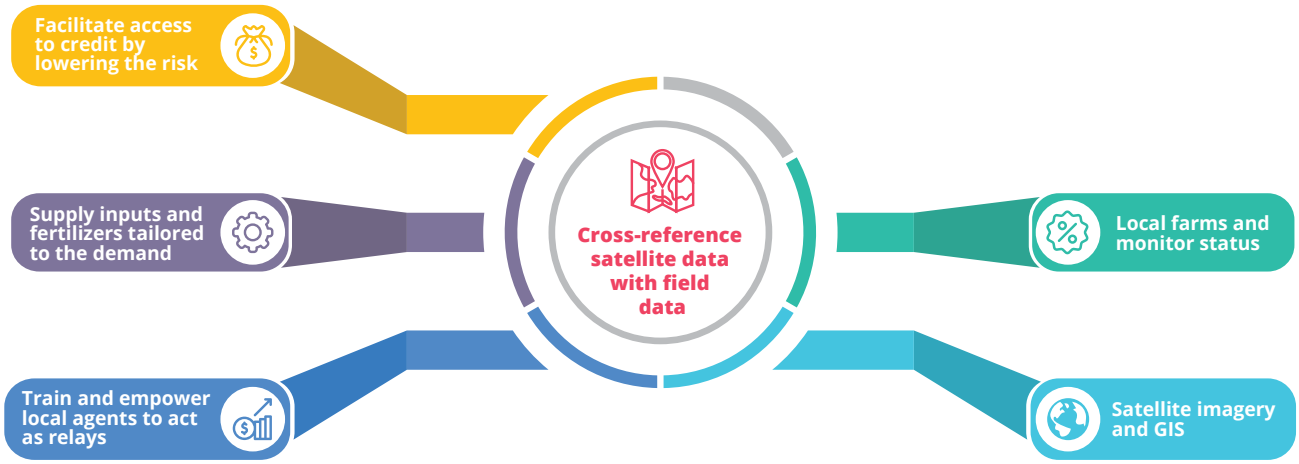
This model aims to reduce investment risks across the value chain, based on data collected using satellite imagery at the farm level. The farm-collected data can be used to identify a farm's needs in terms of inputs, irrigation, and agricultural practices. This information can help other actors across the value chain better target their interventions. With the appropriate irrigation mechanisms and the use of improved seeds, farms can increase their productivity and lower the risk associated with formal credit opportunities.

43. agCelerant. (n.d). "Phygital Agriculture." https://www.agcelerant.com/phygital-agriculture/

Figure 9: Proposed Model: Lowering Investment Risk with Satellite Data

In this model:

- Satellite imagery is used to delineate farm boundaries and monitor farm status.
- Given the limitations of resolution in satellite images shared by all KIIs currently using satellite services, train and empower local relay agents to:
  - Cross-reference satellite data with field data, confirming boundaries and farm overall status, including soil types, irrigation needs, and pest and disease control needs.
  - Collect farmer needs in terms of seeds, fertilizers, and other inputs, as well as needs related to technologies and techniques.



The final cross-referenced data can be used for various purposes, including: design to reduce investment uncertainty; identifying soil related challenges; estimating the demand for seeds and other inputs in response production objectives; identifying capacity-strengthening activities related to farm maintenance, harvest, and post-harvest techniques to reduce losses; and/or to encourage the farming of different crop varieties. Satellite imagery can also be used to monitor farm status and assess the application level of best practices aimed at improving productivity, further lowering investment risks for credit institutions.

This model bypasses the challenges related to the fragility of public institutions, establishes a healthy supply and demand environment, and relies on local partnerships to respond to challenges related to high illiteracy rates and travel restrictions. It also prioritizes interactions between different stakeholders in the agricultural sector value chain while targeting interventions and activities to support farmers' demands and needs.

USAID/Mali Role: **Advisory**

With this approach, USAID/Mali's role would primarily be coordination, which could include:

- Advising hiring local agents to cross reference data collected through products already using satellite imagery;
- Sharing the data with private sector investors and development partners (once cross-referenced and validated) to provide a better understanding of demand and to identify needs and priorities that could address farm health and production;
- Identifying farms with high productivity potential to include in a pilot project with financial institutions. Focusing on farms with high productivity potential can reduce investment risks and encourage financial institutions to facilitate access to formal credit.

10. Improve community participation. The assessment revealed that community participation and involvement in current ICT implementation is a key success factor, as it can alleviate several challenges such as high illiteracy rates, end-user reluctance, and travel restrictions imposed by the current security challenges.

For projects funding the implementation of an ICT product, the local partner could centralize user feedback that can be used to improve the product. For more support-based projects, having a local partner will support local capacity building and continuous training and ensure a local presence for the partner or the agro-business dealers.

Other cross-cutting benefits include providing opportunities for youth empowerment (youth who could be trained as local representatives) and for women's involvement and outreach, as women are often isolated from activities outside of their communities.

ICT partners who are already implementing this localized approach noted that basic computer and software training may be needed upfront and emphasized that turnover rates are high among relay agents, as agents are often mobile and looking for better financial opportunities.

USAID/Mali Role: **Advisory**

USAID/Mali should advise their partners to factor basic computing skills into their projects and recommend that projects treat field agents as key personnel, securing a multi-year commitment (of 2 to 3 years, for example) for all field agents who received training for a specific project.

ANNEX 1 - LIST OF INTERVIEWS



Agence des Technologies de l'Information et de la Communication (AGETIC)

Agribox

AMASSA

Association of Professional Farmers' Organizations (AOPP)

Autorité Malienne de Régulation des Télécommunications/TIC et des Postes (AMRTP)

Badenya Women Farmers Boidié Cooperative

CARE

Cultivating New Frontiers in Agriculture

DevWorks International

DRA/Ségou

Helvetas

ICRISAT

International Livestock Research Institute

JINOV

Lenali

Lutheran World Relief

Ministry of Agriculture

Ministry of Communications

Ministry of the Environment, Sanitation and Sustainable Development

MyAgro

National Coordination of Farmers' Organizations (CNOP)

Northwestern University

Observatoire du Marché Agricole

OKO Finance

Orange Mali

Partnership for Enhanced Engagement in Research (PEER)

RTI International

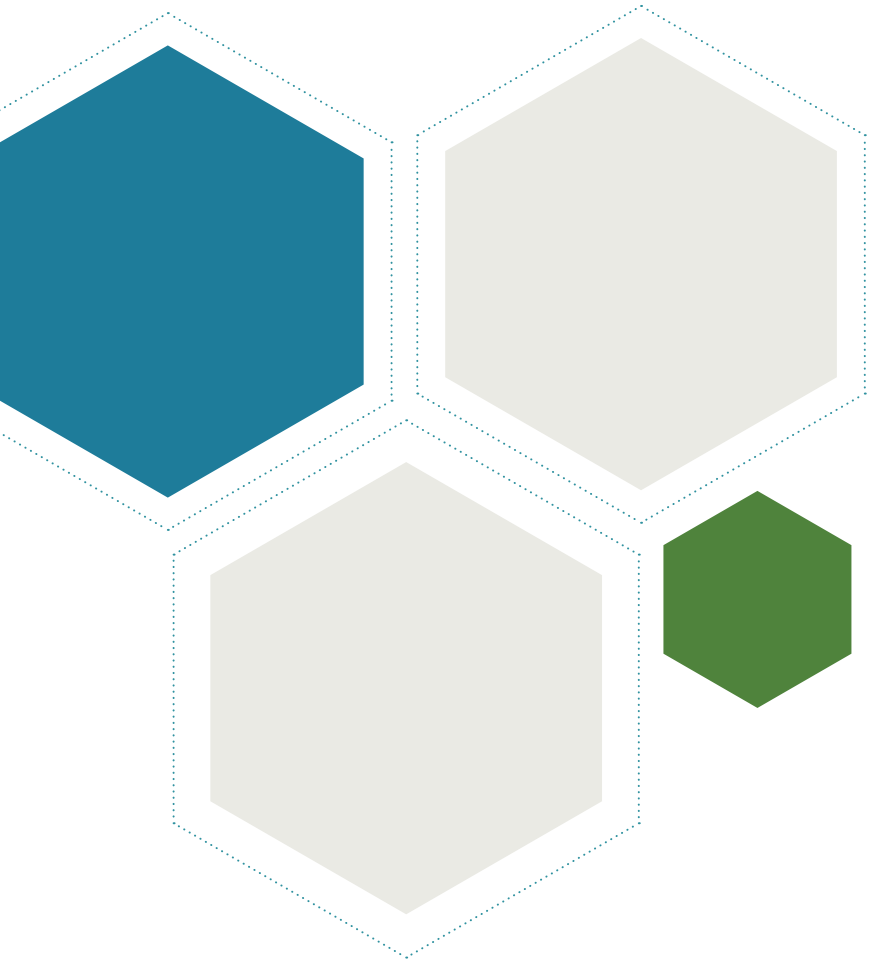
SNV

Soil-Water-Plants Laboratory, Institute of Rural Economy (IER)

Texas A&M University, Borlaug Institut

Winrock International

VIAMO



DIGITAL AGRICULTURAL ECOSYSTEM IN MALI

DEVELOPMENT GATEWAY
An IREX Venture

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