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Analysis of Digital Agriculture Extension and Advisory Services in Niger

Developing Local Extension Capacity (DLEC) Project

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ACRONYMS AND ABBREVIATIONS

APCA	Agricultural Advisory Promotion Agency
ASG	Advisory Service Groups
CORAF	African Council for Agricultural Research and Development
CRA	Regional Chambers of Agriculture
CSAN	Center for Food and Nutrition Security
DGA	General Directorate of Agriculture
DGPIA	General Directorate of Animal Production and Industries
DGSV	General Directorate of Veterinary Services
DLEC	Developing Local Extension Capacity
DMN	National Meteorological Directorate
EAS	Extension and Advisory Services
FFP	The Fund For Peace
FEWSNET	Famine Early Warning Systems Network
GDI	Gender Development Index
GDP	Gross Domestic Product
GFRAS	Global Forum for Rural Advisory Services
HDI	Human Development Index
ICTs	Information and Communications Technology
IFDC	International Fertilizer Development Center
IFPRI	International Food Policy Research Institute
iREACH	Research, Extension and Advisory Coordination Hub
IVR	Interactive Voice Response
ONAHA	National Office of Hydro Agricultural Management
POs	Peasant Organizations
RECA	National Network of Chambers of Agriculture
SIMA	Agricultural Market Information System
SIMB	Livestock Market Information System
SMS	Short Message Service
SNCA	National Agricultural Advisory System
SOILS	Sustainable Opportunities for Increasing Livelihoods with Soils
SVPP	Local Private Veterinary Services
USAID	United States Agency for International Development
USSD	Unstructured Supplementary Service Data
WFP	World Food Programme

EXECUTIVE SUMMARY

Introduction

The Sustainable Opportunities for Increasing Livelihoods with Soils (SOILS) Consortium led by the International Fertilizer Development Center (IFDC) intends to establish a technology park in Niger. The park will function as information and training service center and project agricultural information and innovations to accelerate dissemination and scaling efforts, provide training to farmers and other agricultural value chain actors. The SOILS Consortium in collaboration with the Feed the Future Developing Local Extension Capacity (DLEC) project conducted this study to analyze the digital agricultural extension and advisory services in Niger to support creation of the technology park and to provide insights and recommendations on how the SOILS Consortium can better use digital extension platforms and services to increase the reach of their activities.

Methodology

A mixture of quantitative and qualitative data collection methods was used, and both primary and secondary data were collected in three phases from December 2020 to January 2021. In phase I, stakeholder engagements and literature review helped to identify digital extension and advisory services (EAS) platforms being deployed in Niger, obtain secondary data for the analysis of the EAS landscape and digital ecosystem in Niger. This was followed by an online survey ran for three weeks and responded to by 23 digital agriculture and agricultural development experts whose opinions formed the basis for the evaluation of the accessibility, quality and effectiveness of the digital EAS platforms identified in phase I. A second online survey also ran for three weeks targeted only digital EAS providers with five responding and providing detailed information on their platforms/services. A review of the Technical Centre for Agricultural and Rural Cooperation (CTA) digital agriculture (D4Ag) solutions database provided data on other digital platforms. Phase III involved farmer feedback gathering through phone interviews with 47 selected farmers currently accessing the main digital EAS platforms from six regions in Niger.

Findings

Agricultural extension and advisory services landscape in Niger

Agricultural extension and advisory services in Niger have evolved over time, from a single model run solely by the state and focused on cash crops to a current pluralistic model with a wider range of crops and involving private actors. This evolution was influenced by the implementation of several development projects by international organizations. The Regional Chambers of Agriculture (CRA) were established in 2000 to facilitate the strengthening of public and private extension and advisory services. In 2011, the 3N Initiative ("Nigeriens Feed Nigeriens") was established by the state to contribute to the sustainable protection of the Nigerien population from hunger and malnutrition and improve income. In 2017, a new National Agricultural Advisory System was created with the aim of coordinating extension and advisory activities, linking research and development, and improving access of farmers and other actors to quality agricultural advisory services. Currently, public

institutions and farmer organizations each contribute 30 percent of extension agents with the remaining provided by other private actors.

The dominant approaches used for EAS delivery include demonstrations and field visits, farmer field schools, fairs and shows and farmer-to-farmer extension. The main drawbacks, however, are the low rate of coverage of farmers with women less served; focus on production advisory services than other types of advice; a plurality and diversity of advisory systems with limited coordination; absence of innovative financing mechanisms and dependence on donor funding.

Digital extension and advisory services in Niger

The analysis of the digital agricultural EAS in Niger was based on the digital agriculture framework (Addom, 2020) and its four pillars: the **enabling environment** (e.g., mobile networks, internet connectivity, mobile phone penetrations, literacy and skills, policies and strategies) and **data infrastructure** to support **digital innovations** to work and the **business development services** (e.g., financing and business models) backing the digital innovations to thrive.

The enabling environment for digital EAS in Niger

Niger has a gradually improving enabling environment to support digital EAS. 4G network is in an infant stage but 3G access has risen from 10 percent of the population in 2016 to 24 percent in 2019, while 92 percent has access to 2G network. Mobile phone ownership has increased from 30 percent in 2015 to 37 percent in 2019 with unique mobile subscribers doubling to 37 percent within the same period. In 2019, GSMA projected a 3.7 million increase of the unique mobile subscribers by 2025, which is one of the fastest rates in West Africa. Smartphone adoption is currently around three percent of total mobile connections, but on the rise. Gender disparity in mobile ownership is evident – more women own basic phones while more men own feature and smartphones. Mobile internet subscription is currently 18 percent of the population and progress has been slow and inconsistent. Consumer readiness and affordability are barriers to mobile internet connectivity, but the biggest obstacles are digital infrastructure and local content and services development. The adult literacy rate of 35 percent is the second lowest in the Sahel. This is improving but the gap between men (44 percent) and women (27 percent) is still wide. Access to electricity is limited particularly in rural areas and this has not improved within the last five years.

Data infrastructure to support digital EAS

Niger has quality data infrastructure ranging from **soils** (e.g., Atlas of land use maps of Niger), **weather** (e.g., National Meteorological Directorate - DMN), **agronomy** (e.g., FAO Crop calendar, FeSeRWAM) to **market information** (Agricultural Market Information System - SIMA for crops; Livestock Market Information System - SIMB for livestock), with various research institutions providing quality data to support these. Many higher institutions provide agricultural training for extension agents and other professionals. Digital identity is still a constraint. The National Network of Chambers of Agriculture (RECA) e-Extension system has digitally profiled 24,000 farmers nationwide but there is no national digital database of farmers.

Digital innovations (platforms) for EAS in Niger

A host of public and private digital platforms are available within the digital landscape of Niger and other West African countries to support EAS in Niger. The state platforms such as DMN, SIMA and SIMB, and the private owned e-Extension system of RECA are the dominant EAS platforms in Niger. Each has a nationwide coverage, provide specialized and bundled services via a diversity of digital tools in French and local languages, with relatively large number of farmers accessing the services which are rendered free of charge. Other digital platforms such as Labaroun Kassoua, Tele-Irrigation, Agritech, Espace Geomatique, E-KOKARI and Center for Food and Nutrition Security (CSAN) are also being accessed by some farmers or deployed by development projects to support EAS.

Business development services and sustainability of digital EAS in Niger

The digital EAS platforms in Niger are largely funded by international donors and development partners, and they provide free EAS to farmers. This funding mechanism does not guarantee sustainability of adoption and scaling of digital services. Farmers are willing to pay for advisory services that respond to their specific problems and new and innovative financing mechanisms are being tested. A pilot business model based on the cost of SIM card is being tested by RECA, Viamo and Airtel where farmers pay for one Airtel SIM card to access available EAS developed by RECA on an IVR protocol implemented by Viamo.

Accessibility, quality and effectiveness of digital EAS platforms/systems in Niger

Despite the limited mobile network coverage, low digital literacy and other barriers indicated above, the prevailing digital EAS platforms in Niger are rated by more than two-thirds of digital agriculture and agricultural development experts as being accessible, effective, providing quality content and services that are useful and largely match the specific needs of farmers in Niger. RECA's e-Extension system, based on the expert views appear to be the most accessible and effective with numerous digital tools and services that suit the situation of diverse rural farmers. Feedback from framers' using these platforms corroborates the views of the experts about accessibility, effectiveness of the platforms and usefulness of their services.

Conclusions and Recommendations

The study concludes that:

- The low coverage of farmers by extension agents compounded by the restrictions on mass gatherings due to the COVID-19 pandemic and the limited coordination and collaboration among EAS providers have reduced the potential benefits of traditional EAS in Niger.
- Digital EAS could be a game changer for smallholder farmers and other actors to access or render quality EAS from the comfort of their homes or workplaces.
- Niger has a limited but gradually advancing enabling environment and agricultural data infrastructure that support digital agriculture. There is thus a reasonable number of quality digital platforms which are accessible and effective in providing or supporting quality EAS that largely meet the needs of farmers and other actors across the country.

- Digital agricultural extension activities appear to be driven by donors and international development partners which do not guarantee sustainability of the digital EAS platforms.

The study also recommends:

- There should be active coordination of EAS providers to avoid duplication, enhance synergy and complementarity necessary to serve the diversified needs of farmers.
- There should be continuous capacity building to facilitators and moderators on one hand, and farmers on the other due to the low digital literacy in Niger.
- Development of a national farmer digital identity database should be a priority of the state and relevant private actors – with databases of RECA, peasant organizations and others as a starting point.
- The National Agricultural Advisory System (SNCA) should take a lead in exploring sustainable and innovative financing mechanisms for agricultural extension that minimize the dependence on donor funding.

1. BACKGROUND

The United States Agency for International Development (USAID) Bureau for Resilience and Food Security have been supporting the Sustainable Opportunities for Increasing Livelihoods with Soils (SOILS) Consortium through the International Fertilizer Development Center (IFDC) along with its collabrative partners since 2019. The primary goal of the SOILS Consortium is improving the soil fertility in the most vulnerable regions of sub-Sahara Africa.

As part of the Research, Extension and Advisory Coordination Hub (iREACH) in West Africa along with West and Central African Council for Agricultural Research and Development/*Conseil Ouest et Centre Africaine pour la Recherche et le Développement Agricoles* (CORAF), the SOILS Consortium has been supporting CORAF to better coordinate, align and integrate research, extension and advisory activities in the region for efficient use of resources and to meet the demands of different clientele including producers, researchers, policymakers and the private sector. In an initial pilot phase of approximately four years, iREACH will have a particular, although not exclusive, focus on USAID's activities in Feed the Future and Resilience Zones in Burkina Faso, Ghana, Mali, Niger and Senegal. iREACH's proposed objectives are to:

i) improve coordination, alignment and integration of relevant activities;
ii) create and strengthen technology parks and facilitate effective flow of information and innovations; and
iii) build human and institutional capacity via trainings and knowledge management support.

The SOILS Consortium is establishing a technology park in Niger. Technology parks are designed to house and showcase proven technologies from the region to facilitate adoption and scaling. In Niger, the SOILS Consortium will concentrate on promoting technologies on soil management and dual-purpose cropping of cowpeas and millet. The technology park in Niger is expected to be set up in early 2021.

Technology park, virtual in nature or physically located at a relevant facility, will function as information and training service center, and will be established or strengthened within the relevant agro-ecological zone of the country. The technology park will highlight information and innovations for the wider agricultural development community to accelerate dissemination and scaling efforts and to provide training, establish new partnerships and agri-business development opportunities to a wide range of stakeholders; and amplify the impacts of USAID investments and leverage the outcomes from other development community activities.

To support the process of establishing a technology park in Niger, the SOILS Consortium is collaborating with the Feed the Future Developing Local Extension Capacity (DLEC) project to conduct this study. DLEC galvanizes diverse extension and advisory services stakeholders to measurably improve agricultural extension programs, policies and services. DLEC accomplishes this objective through three interrelated sets of activities:

(i) Country Diagnostics to make recommendations and inform strategies,

(ii) Action Research Engagements to test interventions and build an evidence base, and
(iii) Communities of Practice to share and advocate for proven best-fit practices in extension.

DLEC (2016-2021) is led by Digital Green in partnership with organizations such as the International Food Policy Research Institute (IFPRI) and the Global Forum for Rural Advisory Services (GFRAS).

The agro-sylvo-pastoral and fisheries sector is Niger's main source of economic activity, employing 80 percent of the working population and contributing an average 37 percent to the formation of Gross Domestic Production. In Niger, agricultural Extension and Advisory Services (EAS) have a key role to play in harnessing opportunities of the agricultural sector. In fact, EAS play four essential functions for farmers and other actors in agricultural value chains: **access to innovation and technology**, capacity building, facilitation and support for decision-making processes (Djamen, 2019).

This study report analyzes the traditional and digital agricultural extension and advisory services in Niger and gives insights and recommendations on how the SOILS Consortium and its implementing partners can better use digital extension tools, platforms, approaches and services to increase the reach and success of their activities and help strengthen resilience in Niger.

2. METHODOLOGY

A mixture of quantitative and qualitative data collection methods was employed in this study, and data obtained from multiple sources in Niger – both primary and secondary. Data collection was conducted in three phases from December 2020 to January 2021.

Phase I involved a preliminary literature review, and informal engagements with some digital agriculture stakeholders in Niger, mainly digital incubators and those identified through the AgriHack Talent Initiative Network (a networking and knowledge-sharing platform for digital agriculture innovators across Africa) of the Technical Centre for Agricultural and Rural Cooperation (CTA). These helped to identify digital agricultural solutions (D4Ag solutions), or digital EAS platforms or systems being deployed for extension delivery to farmers in Niger. The preliminary literature review and stakeholder interactions also helped to profile potential experts who formed the respondents for the online survey for experts' opinion gathering to assess the effectiveness of the identified digital EAS platforms/systems. Phase I also involved detailed literature review and secondary data collection on the EAS landscape and digital ecosystem in Niger and the West Africa as a whole.

In phase II, two online surveys were conducted to: 1) gather data from experts for evaluation of the quality and effectiveness of the digital EAS platforms/systems in Niger, and 2) to obtain detailed information from digital EAS providers regarding their platforms (e.g., tools used, reach, type(s) of services provided, subscription type, etc.). The first survey for expert opinion gathering was run for three weeks from December 2020 to January 2021 and targeted agricultural development and digital

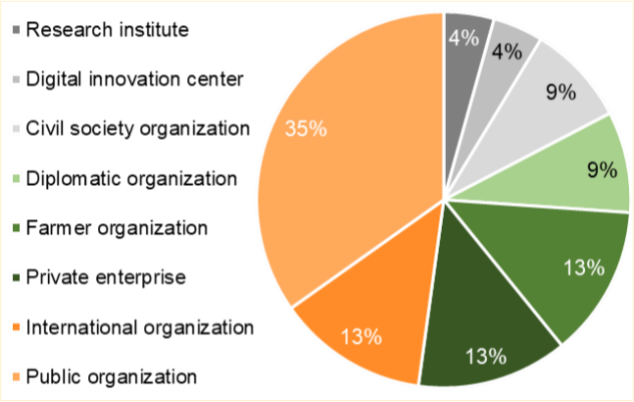

Figure 1: Distribution of stakeholder groups of the digital agriculture and agricultural development experts that responded to the online survey for expert opinion gathering

agriculture experts from diverse stakeholder groups including policymakers, digital technology centers, national ministries (especially technical departments responsible for agricultural extension and technology transfer), national, international and donor organizations, diplomatic agencies, farmer organizations and agricultural research institutions operating in Niger and the Sahel region (Figure 1). A total of 23 experts responded to the survey within the stipulated timeframe. The second survey which also ran for three weeks in January 2021 targeted the main providers of digital EAS platforms or systems in Niger identified in phase I and validated by the experts' opinion in phase II. Five service providers responded to this survey (Annex 1a). Data on the other digital platforms were sourced from CTA's D4Ag solutions database complemented with information collected from the websites of the respective digital platforms where applicable (Annex 1b).

In phase III, follow-up phone interviews were conducted with some of the digital agriculture experts that responded to the online survey to gain additional insights on some of the responses and digital EAS in Niger. Also, phone interviews were undertaken with 47 farmers currently accessing the four main digital EAS platforms/systems and pooled from six regions in Niger – Agadez, Maradi, Niamey, Tahoua, Tillaberi, and Zinder, to gather feedback on the prevailing digital EAS platforms/systems.

3. NIGER'S AGRICULTURAL SYSTEM

The Republic of Niger is one of the largest countries in the Sahelian region and West Africa. The country is considered as one of the highly fragile countries based on the 2020 Fragile States Index (FSI)[1] report, ranked 19th most fragile among 176 countries, and 14th in Sub-Saharan Africa (Messner De Latour, 2020). The measure of fragility considers socio-economic and political pressures, and these in addition to the prevailing climatic and institutional settings in Niger make the country one of the most vulnerable globally (World Bank, 2013; Messner De Latour, 2020). The country is also lowly ranked in many of the human development indicators. For instance, its Human Development Index (HDI)[2] value of 0.394 based on the Human Development Report 2020 (UNDP, 2020) makes it the least ranked (189th) country globally. Human development is even weaker among women as indicated

[1] The FSI is an annual assessment of 178 countries to determine the condition of each country in terms of social, economic, and political risks or pressures, and it is published by The Fund For Peace.
[2] The UNDP defines HDI as a "summary measure of average achievement in three key dimensions of human development such as a long and healthy life, being knowledgeable and having a decent standard of living".

by an HDI value of 0.321 compared with that of men (0.443). The Gender Development Index (GDI)[3] value of 0.724 is one of the lowest in Africa and a further indication of the lower development of women in Niger in terms of health, education and living standards.

The current estimated population of 23.3 million people based on the World Population Prospects 2019 makes it the fourth most populated West African country behind Nigeria, Ghana, and Côte d'Ivoire (United Nations (UN), 2019a). This is expected to expand rapidly as the annual population growth rate of 3.8 percent is the highest in Africa, and one of the highest globally. Projections from the Population Division of the Department of Economic and Social Affairs of the UN suggest that there is a probability of Niger's population almost tripling between 2019 and 2050 (United Nations, 2019a). Such anticipated rise in population is largely due to multiple factors including a high fertility rate of seven live births per woman (United Nations, 2019a) and high rate of early marriage as 76 percent of married women between the ages of 20–24 years do so by age 18 (UNDP, 2020).

Aside the human development and demographic challenges, the country also faces difficult and uncertain climatic conditions for agriculture production. Historical climate data analysis indicates a slight decline in annual rainfall, a rise in monthly temperatures, increased numbers of warm days, and lengthening of the dry season (World Bank, 2020). Climate projections for Niger and the Sahelian region suggest further rise in temperature but the high inter-annual variations in rainfall make it uncertain to predict future rainfall trends.

The country is divided into five agro-climatic zones, otherwise referred to as agro-ecological zones, and each zone, based on the prevailing rainfall, is deemed either suitable for crop, livestock, or mixed crop-livestock production. The Sahara agro-climatic zone (with less than 200 mm rainfall per annum) is the largest among the five zones, occupying three-quarters of the total land area and used predominantly for livestock production. The two wettest agro-climatic zones, Sudano-Sahel zone (400 – 600 mm annual rainfall) and Sudan zone (600 – 1000 mm annual rainfall) in the southern part of the country are relatively more favorable for crop-livestock production but cover only seven and one percent respectively, of the total land area. Less than 10 percent of the total cultivated land is irrigated (World Bank, 2013).

Agriculture production is characterized by intrinsically poor soil fertility and this coupled with the limited use of fertilizers, current average of 0.4 kg per hectare, have led to poor crop yields that have persisted over many decades. Multiple reasons including lack of access to fertilizers and credit to acquire the required fertilizers, and limited knowledge on the use of fertilizers (type, quantity, suitable application methods and time, etc.) have combined to stifle smallholder farmers capacity to apply adequate amounts of fertilizers to increase crop yields.

[3] The GDI is the ratio of female HDI to that of men and measures gender gaps in human development by accounting for disparities between women and men in the three basic dimensions of human development namely health, knowledge and living standards.

Millet, sorghum and cowpea are the three main crops cultivated, and together they make up more than 80 percent of the total cultivated land. These crops are mostly intercropped, the dominant cropping system fundamentally practiced, with the purpose of mitigating the risks of total crop failure due to the poor and unpredictable climatic conditions. With intercropping, farm families could obtain some food in the event of a climatic shock and one of the crops fails to produce any yield. Cowpea doubles as a cash and food crop, and together with onions are the main export crops. In fact, Niger is the second largest producer and exporter of cowpea in West Africa, only behind Nigeria. Just like many other Sahelian countries, Niger has a comparative advantage in pastoralism due to the availability of vast rangelands suitable for the extensive system of livestock management. Cattle and camels, and in the case of small ruminants, sheep and goats are the major livestock herded by many households. The country boasts the largest herd population in the Sahel and livestock production contributes around 40 percent to the agricultural GDP (World Bank, 2013).

As is the case in many West African countries, 84 percent of the Nigerien population lives in rural areas with agriculture, mostly in smallholdings, as the main source of livelihood – food and income. The economy of Niger is largely dependent on agriculture with the sector contributing about 40 percent to the national GDP, and accounting for 75 percent of the total population in employment (UNDP, 2020). This is expected to put a huge pressure on farmers and the already fragile natural resources for agriculture production to substantially increase food production towards feeding the growing population and contributing to national socio-economic development. This necessitates sustainable intensification of crop and livestock production to drastically increase productivity.

The many complex agricultural production challenges (e.g., poorly fertile soils, low and erratic rainfall regime, floods, drought, lack of adequate market information, low human and socio-economic development, etc.) make the predominant smallholder farmers face uncertain situations in attempting to intensify food production. Thus, farmers require adequate access to quality EAS to enable them increase productivity towards enhancing food and income security.

In recent times, digitalization of African agriculture has gained momentum with diversity of digital tools, platforms and services emerging and being deployed to support delivery of EAS to farmers. The digital agriculture agenda is partly intended to transform African agriculture towards increasing resilience of production systems and to increase food production and income of farmers and other actors within the agricultural value chains. The digitalization agenda has not only been about development and deployment of digital solutions but include establishment of digital agricultural extension systems or platforms for digital delivery of extension and advisory services to farmers. The COVID-19 pandemic and the restrictions that come with it have limited the potential effectiveness of the traditional agricultural extension delivery systems. Essentially, digital EAS delivery has become more important now than it was in the pre-COVID-19 era.

Niger is a youthful nation as half of the current population are under the age of 15 years, a further 20 percent aged between 15 and 24 years with a median age of 15.2 years (UN, 2019b). Around 25 percent of these youth are neither in school nor in employment (UNDP, 2020). Like other sub-Saharan African countries, the youth are not attracted to agriculture due to the use of traditional methods for crop and livestock production and the associated low income earned by farm families. But youth are more adventurous, and digitalization of agriculture (including digital EAS delivery) could attract them to agriculture and related enterprises. This will enable them to create jobs for themselves and others, reduce unemployment in the country and contribute to inclusive national socio-economic development.

4. FINDINGS

4.1 Agricultural extension and advisory services landscape in Niger

4.1.1 Evolution of agricultural extension and advisory services

There is no documented evidence of any form of EAS in Niger during the pre-independence era. After independence in the 1960, agricultural extension delivery in Niger was entirely the responsibility of the state, and was focused on cash crops, groundnuts and cotton (Kamar, 2013; Rigourd et al., 2016a). After the devastating drought of 1972-1973, the extension system evolved and included a wider range of crops (Comité Interministériel de Pilotage de la Stratégie de Développement Rural, 2010; Rigourd et al., 2016a). Such evolution was influenced by the implementation of several development projects by international organizations that had extension delivery services as part of the project packages. These shaped the extension system into a training-based approach and technology transfer to farmers.

The most significant progress occurred between 1988 and 1998, during the implementation of the Program to Strengthen Agricultural Support Services (PRSAA), and the National Program for Agricultural Research (PNRA) that introduced the **Training and Visit** (T&V) approach of extension services delivery. With this approach, contact farmers and basic extension agents were brought together for training and technology transfer, learning journeys to well-established and functional farms and facilities were organized for farmers, and link between agricultural extension and research institutions was established (Rigourd et al., 2016a). The period is documented as the most important for agricultural extension and advisory services delivery and development in Niger since independence, *and the model was also the only national agricultural extension model used at the time*. The PRSAA and PNRA programs were funded by the World Bank and like many other development projects, this model and the momentum of agricultural extension faded following the closure of those programs (Kamar, 2013; Rigourd et al., 2016a, 2016b). A key drawback of this system was its seemingly 'top-down' approach in designing training and other extension activities. This means that farmers were usually not involved in developing the support or services. Additionally, the link between research and extension was weak and research information rarely reached farmers.

During the same period, the state begun to partially disengage from agricultural extension and advisory services delivery (Rigourd et al., 2016a, 2016b). This together with the closure of the PRSAA and PNRA programs in 1998 resulted in limited agricultural extension and advisory services to farmers, and most importantly, marked the end of the era of single national EAS model. This ushered in the period of private actors, particularly farmer organizations, consulting service groups, service provision centres, proximity private veterinary services, and other entities in developing and providing extension and advisory services to farmers (Government of Niger, 2017).

The environmental, socio-economic, and human development uncertainties within which the farmers operate meant that delivery of EAS ought to be further developed and/or strengthened. Consequently, the Regional Chambers of Agriculture (CRA) were established in 2000, enabling the Nigerien state to obtain an instrument which facilitates the strengthening of public and private extension and advisory services. CRA represents the interest of all actors in the entire agricultural value chains in Niger. The CRA was mandated to:

- Raise awareness of the concerns of various categories of rural farmers and assert their points of view in the context of development policies and programs.
- Keep rural farmers informed in any area of interest and facilitate their access to services and resources by providing them with adequate guidance and advice.
- Support rural farmer organization in implementing their projects, by promoting their organization and facilitating the mobilization of technical and financial support needed.
- Defend the interests of rural producers.[4]

In 2011, following a food crisis that further deepened the country's vulnerability to food insecurity, the government decided to implement the 3N Initiative, "Nigeriens Feed Nigeriens". The overall objective of the program was to contribute to the sustainable protection of the Nigerien population from hunger and malnutrition. The 3N Initiative was also meant to guarantee the people of Niger better conditions to improve their income and contribute to national socio-economic development. The results of the activities implemented under the 3N initiative from the onset up to 2015 revealed that the agricultural advisory component was one of the relatively neglected objectives.

As observed by Rigourd et al. (2016a, 2016b), extension and advisory systems in Niger is characterized by several factors including:

- The absence of a unified national rural advisory system.
- A plurality and diversity of advisory systems but no coordination between them.
- A low rate of coverage of farmers, even lower for women.
- The partial match between offers from service providers and requests or needs of farmers.
- Absence of innovative financing mechanisms and dependence on international donors.

[4] https://reca-niger.org/IMG/pdf/Niger_loi_chambre_agriculture-2.pdf

Based on the predicaments discussed above, the Nigerien authorities, under the leadership of the 3N Initiative High Commission, created a new **National Agricultural Advisory System (SNCA)** in 2017. SNCA was aimed at improving access of farmers, their organizations and other actors across the value chains to quality agricultural advisory support services.[5] SNCA is not an organization, rather, it is an on-the-ground advisory system implemented and managed by different (public and private) actors who have been accorded the responsibility to coordinate advisory activities, link research and development, and develop technical messages and intervention methods (Government of Niger, 2017). SNCA is steered by a Strategic Orientation Committee, which is multisectoral and brings together all the actors involved in the National Agricultural Advisory System. For operational management, an Agricultural Advisory Promotion Agency (APCA) was created in 2017 to lead the SNCA and coordinate operational advisory systems. The APCA works under the supervision of the Ministry of Agriculture and does not provide extension and advisory services directly to farmers. The SNCA strengthens and enhances the know-how of actors in the national agricultural advisory system (state services, farmers' organizations, chambers of agriculture, Consulting Service Groups (GSC), Proximity Private Veterinary Services (SVPP), etc.) by coordinating their activities and facilitating their access to funding and co-financing some of their activities.

At present, there is a diversified, pluralistic form of EAS delivery to farmers with many public and private entities involved through: Ministries of Agriculture & Livestock; Environment and Hydraulics financed with state funds; national and international development projects financed by donor funds; farmer organizations (e.g., FUGPN Mooriben, FUCOPRI, FCMN Niya, ANFO, and AREN, etc.); and other private advisory entities (e.g., SVPP, input dealers, etc.). As shown in Figure 2, public institutions (ministries) and farmer organizations each take a 30 percent share of the number of agents involved in agricultural EAS provision in Niger. The remaining 40 percent is filled by other private entities.

[5] http://extwprlegs1.fao.org/docs/pdf/Ner178857.pdf

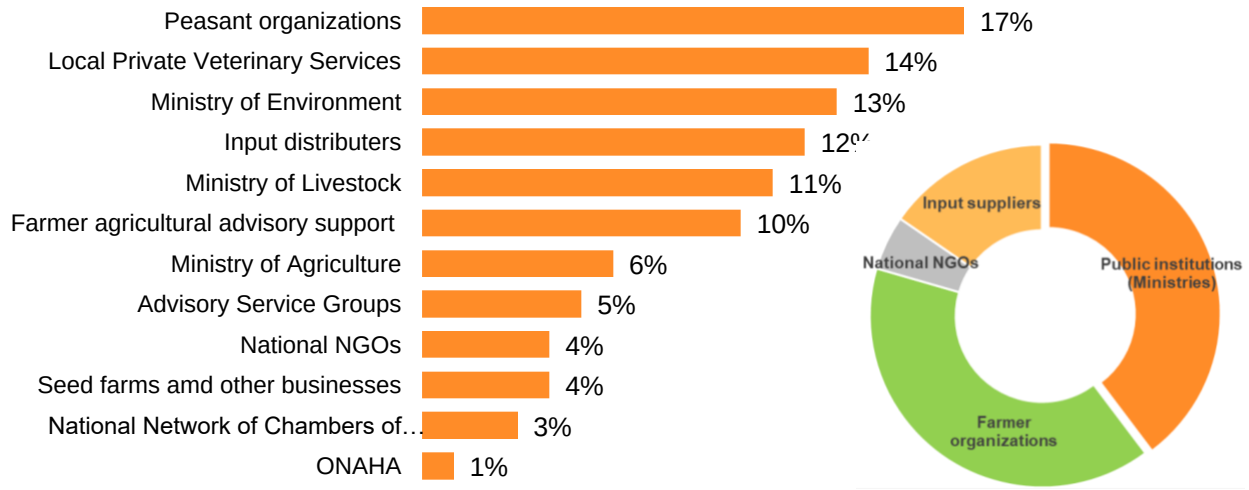

Figure 2: Relative share of the different actors providing EAS services in Niger. (Source: Grain de sel nº 77 - January - June 2019)

4.2 Agricultural extension and advisory services providers in Niger

4.2.1 Public EAS providers

The 1990s saw the end of a single national EAS model and led to the era where the responsibility of the state to support EAS to farmers got vested into the hands of the Ministry of Agriculture and Livestock where EAS are performed by specific technical departments. The total number of public extension agents is estimated at 3,000; about half of this number is expected to be at the departmental offices leaving around 1,000–1,500 extension agents directly in the field and in contact with farmers (Rigourd et al., 2016b). This translates to one extension agent to approximately 2,000 to 3,000 farmers per state deployed extension agent (Rigourd et al., 2016b). It is thus not surprising that some rural farmers indicated that they have never met an extension agent before. Below is some information on the mandates or roles of the designated ministry and the respective technical departments.

i) Ministry of Agriculture and Livestock

The Ministry of Agriculture and Livestock has four technical departments, 331 agricultural districts (Rigourd et al., 2016b), and is responsible for providing public EAS to farmers across Niger (Kamar, 2013).

General Directorate of Agriculture (DGA)

The DGA is the main body in charge of rural agricultural extension and advisory activities. It implements the national agricultural development policy and coordinates the activities of the related national directorates. DGA is organized into four national technical departments, namely: The Departments of Agricultural Mechanization; Seed Control and Certification; Promotion of Plant Sectors and Quality; and Agricultural Extension and Technology Transfer. Each department performs specific technical functions. However, the **department of agricultural extension and technology transfer** is responsible for the design, development and implementation of policies and strategies for

extension and technology transfer – thus largely **undertakes extension and advisory services through the field agents**.

General Directorate of Veterinary Services (DGSV)

DGSV designs, develops, and implements the national policy for the development of animal health, veterinary services, and the veterinary profession. Like the DGA, DGSV is organized into four national technical departments. These include departments of food safety and food of animal origin; veterinary inspection; private veterinary pharmacies and promotion of veterinary profession; and department of animal health. DGSV supports the national agricultural advisory system through the departments of animal health, and that of food safety and food of animal origin. Another role of DGSV is capacity building of actors within the livestock value chain through the dissemination of methods for improving animal health and welfare.

General Directorate of Animal Production and Industries (DGPIA)

DGPIA designs, develops, and implements the national policy for the development of animal production and related sub-industries. DGPIA is also organized into four national technical units, namely the departments for: promotion of the animal sector and quality; pastoral development; animal industries; and genetic improvement and animal biotechnology. Similar to the DGSV, the DGPIA supports the national agricultural advisory system through the activities of the departments for the promotion of the animal sector and quality, and the department for pastoral development. It also undertakes capacity building of value chain actors through the dissemination of methods for improving animal production systems.

National Office of Hydro Agricultural Management (ONAHA)

ONAHA promotes irrigated agriculture in Niger through the construction and management of irrigation schemes. Since 1986, ONAHA was transformed into a public company where cooperatives, the government, and local authorities pay for services provided. As a result, ONAHA has financial autonomy and draws its funding from its commercial activities.[6] ONAHA conducts extension operations and offers agricultural advisory services on demand for hydro-agricultural development, rice cultivation and vegetable crop production.

ii) Subsidiary public EAS support systems

There are several other national institutions and agencies that though they do not directly provide EAS to farmers, they provide some support services to complement extension and advisory services in Niger. These include among others:

- The Ministry of the Environment with which extension and advisory services has been transferred to the town and regional levels for implementation of land restoration operations, the organization and supervision of operators in the promotion of non-wood forest products (Rigourd et al., 2016b).

[6] https://www.comite-costea.fr/content/download/4773/36353/version/1/file/Axe_1_2_Rapport_Diagnostic-specifique_ONAHA.pdf

- The Niger National Institute of Agricultural Research (INRAN), and some public universities in Niger, for instance, the Abdou Moumouni University of Niamey (Kamar, 2013).
- INRAN develops improved crop varieties and technologies for dissemination to farmers.
- The Abdou Moumouni University also trains agricultural professionals with expertise in several disciplines, most importantly expertise in agricultural extension through its College of Agriculture.

4.2.2 Private EAS providers in Niger

i) Peasant Organizations (POs) and farmer advisory support groups

The organization of peasants is not a recent phenomenon in Niger. It has been developed and professionalized over the past 30 years. Though many POs are presently dormant, some professional POs still exist today and are among others, represented by umbrella organizations. Prominent among the current functional POs are presented in Table 1, and together they boast between 200,000 to 250,000 members.

Table 1: Access/reach of the five most prominent POs currently performing EAS in Niger

Name of PO	PO Focus	Access / Reach
FUGPN Mooriben	• Quality seed accessibility • Processing and marketing of agri-food products • Rural youth engagement and entrepreneurship in agriculture • Professionalization of cooperative organizations • Promotion of agroecological practices	• 29 unions; 1,454 grassroot groups; over 60,121 members • 65 technical team members; and 650 lead farmers[7] • 1 advisor to 70 farmers (given the technicians and relay farmers)
FCMN Niya	• Improvement in the production of market garden products through better access to markets and agricultural inputs	• 73 unions; 815 cooperatives; and 35,776 members • 12 technicians; 45 animators; and 600 relay farmers • 1 advisor to 50 farmers (given the technicians and relay farmers)
AREN	• Conflict management, advocacy and defence of the rights and interests of pastoralists	• 2,500 grassroot groups; and 100,000 members
ANFO	• Professionalization of onion producers and modernization of the onion sector	• 19 federations; 300 unions; 2,500 grassroot groups; and 56,000 members
FUCOPRI	• Development of the rice sector through supply of inputs, marketing and advocacy in favour of local rice varieties.	• 13 unions; 70 grassroot groupings; 37 cooperatives; 30 women's groups; and 28,000 members • 5 engineers and 5 technicians at central management level
Source : Rigourd et al. (2016a)		

[7] Lead farmers are members of agricultural cooperatives or any group of farmers who play a leadership role in the transfer of new technologies, know-how, including new agricultural practices to other members

ii) Local Private Veterinary Services (SVPP)

The objective of the SVPP is to sustainably strengthen animal health in a specific area by setting up a basic animal health network, with the participation of breeders and private veterinarians.[8] The SVPP model aims to attract the activities of private operators (e.g., Veto services, *Service vétérinaire de proximité)* to regions with little coverage by promoting para-professionals, community animal health workers or livestock auxiliaries and village animators in poultry farming and small ruminants. It is a community animal health system accessible to relevant farmers, has regular service delivery of adequate quality and economically affordable.[9]

On average, a local private veterinary service includes 1 veterinarian, 1 to 2 assistants and 20 to 30 livestock auxiliaries. The main service of the SVPP is animal health care and vaccination campaigns. In addition to these services, they also provide advice to breeders in the areas of feeding, breeding and livestock management (Rigourd et al., 2016b).

iii) Advisory Service Groups (ASG)

ASG are economic interest groups specialized in agricultural advisory for private or community irrigation. Nearly eight Advisory Service Groups form the Nigerien network of professional organizations for irrigation.

iv) Network of Chambers of Agriculture in Niger (RECA)

RECA exists in all the eight regions of Niger: Agadez, Diffa, Dosso, Maradi, Niamey, Tahoua, Tillabéri and Zinder. RECA is specialized in EAS through the production of technical and economic notes translated into advisory support for farmers. RECA's website[10] is certainly the most resourceful and extensive website for information on agriculture and rural development in Niger. The website is regularly updated with technical notes, reports of extension visits and development projects carried out in Niger and in the sub-region. It has developed and implementing a unique e-extension model in Niger – details can be found in the digital EAS section below.

v) National and international NGOs and donor EAS initiatives

Intergovernmental organizations like FAO, IFAD; international NGOs (e.g., SwissContact, *Vétérinaires Sans Frontières*) and national NGOs (e.g., *Organisation contre la pauvreté*, Karkara, Bonferey, etc.) produce relevant information to support farmers and provide EAS to farmers through their field officers mainly in the framework of their development projects.

vi) Input distributors and seed farms

Some input distributors and seed farmers provide agricultural advisory services to farmers through phone calls or face to face approach. Advisory services mainly center on recommended fertilizer dosages, agro-chemicals handling precautions, as well as agronomic advisory on recommended seed sowing densities or plant populations, etc.

[8] https://veterinairessansfrontieres.be/wp-content/uploads/2018/11/Doc_SVPP_VF.pdf
[9] https://reca-niger.org/IMG/pdf/Guide_SVPP_19_10_2015.pdf
[10] https://reca-niger.org/

vii) Start-ups

There are no start-ups or private enterprises specialized in providing EAS in Niger. However, there is a growing interest for youth-led ag-tech start-ups to provide digital EAS as part of their other activities. Promising among these include Novatech, Tech-Innov, Itech Center, and Espace Géomatique Niger.

4.3 Dominant EAS approaches and methods

4.3.1 Demonstrations and field visits

Field visits are largely adopted by RECA's extension agents. Each week, the Regional Chamber of Agriculture of Niamey organizes field visits to vegetable crop producers. A demonstration guide was produced in November 2020 in the framework of the Niger-German Program for the Promotion of Productive Agriculture (PromAP) to build capacity of key stakeholders in small-scale irrigation for vegetable crops. The regional chamber of agriculture in Zinder uses demonstrations to facilitate the adoption of improved crop varieties by farmers, recommended rates of fertilizer and phytosanitary treatments.

4.3.2 Farmer Field Schools

The use of Farmer Field Schools (FFS) for agricultural extension in Niger started in 2000 within the framework of the Cowpea Africa Project. Since then, hundreds of FFS facilitators have been trained, and hundreds of FFS have been implemented across Niger based on farmers' concerns and needs (e.g., Farmer school garden, Field school vegetable crops, Pastoralist Field Schools, etc.). An official practical guide on FFS was produced in 2014 by the Ministry of Agriculture and Livestock.

4.3.3 Fairs and shows

Fairs and shows are great opportunities for networking, showcasing local products and agricultural innovations, and creating market opportunities for farmers. Several fairs and shows are organized regularly throughout the year at local and national levels in Niger. A digital agriculture competition was organized during the 6th edition of the 2020 Agricultural, Hydraulics, Environment and Livestock Show (SAHEL-Niger) to promote the creation and the development of innovative enterprises serving the agri-food sector. The International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) and the Regional Chambers of Agriculture organize regularly seed fairs to improve farmers' incomes and the dissemination of improved seeds.

4.3.4 Farmer-to-Farmer extension

Scarborough et al. (1997), cited by Davis and Franzel (2018) estimated that given the high demand for agricultural information and the limited capacity of extension services, many organizations use farmer-to-farmer extension (FTFE). FTFE is defined as the provision of training by farmers to farmers, often through the creation of a structure of farmer-trainers. The farmer-to-farmer extension approach is mainly used in Niger through lead farmers to guarantee close supervision. Since 2007, FUGPN-

Mooriben has set up in 15 unions, a network of 328 lead farmers, 31 percent of whom are women, to provide close supervision to members of groups in the implementation of cultivation techniques.[11]

4.4 Drawbacks of EAS in Niger

Visible progress has been made and still being made towards the development and strengthening of the EAS in Niger to better reach and serve farmers. Yet, EAS in Niger still faces a multitude of challenges as presented below:

- There is a low rate of coverage of farmers, with women less served than men. This situation is largely the outcome of limited human resources (extension agents) available to be deployed, and the lack of funding to train more agents. At present, one extension agent serves at least 2,000 farmers, and some regions are more served than others.
- The focus of EAS is on production advisory services with limited to no attention given to other types of advice (e.g., financial services – credit, loans, insurance), market linkages, agribusiness management, etc.) essential for farmers.
- A plurality and diversity of agricultural advisory systems without adequate coordination. The advisory activities are conducted in a parallel fashion with a lack of coordination, collaboration, and synergy building, which would have been vital to better respond to the diversified needs of the varied smallholder farmers, especially women who traditionally receive limited extension and advisory support. Such collaboration will not only bring harmony and complementarity in EAS delivery but will lead to cross-sharing of knowledge and innovations between the service providers to better serve the farmers.
- Absence of innovative financing mechanisms and dependence on international donors and funding provided through implementation of development projects by some international organizations. This casts doubt on the sustainability of EAS, principally that of the private advisory service providers but also the public systems to some extent.
- POs take a reasonable share of the agricultural advisory responsibilities. However, those formed and fully operated by farmers often do not have adequate technical knowledge or capacity to deliver the desired quality of extension and advisory services to farmers.
- Some form of mismatch between offers from service providers and requests or needs of farmers.

[11] https://reca-niger.org/IMG/pdf/RECA_appui-conseil_Note1_21mai2010.pdf

4.5 The digital agricultural ecosystem in Niger

Tsan et al. (2019)[12] define digitalization for agriculture (D4Ag) as *"the use of digital technologies, innovations, and data to transform business models and practices across the agricultural value chain and address bottlenecks in, among others, productivity, postharvest handling, market access, finance, and supply chain management so as to achieve greater income for smallholder farmers, improve food and nutrition security, build climate resilience and expand inclusion of youth and women"*.

The digital agriculture framework (Addom, 2020)[13] developed based on the definition of Tsan et al. (2019) identifies four pillars for analyzing digitalization for agriculture (Figure 3) and described below.

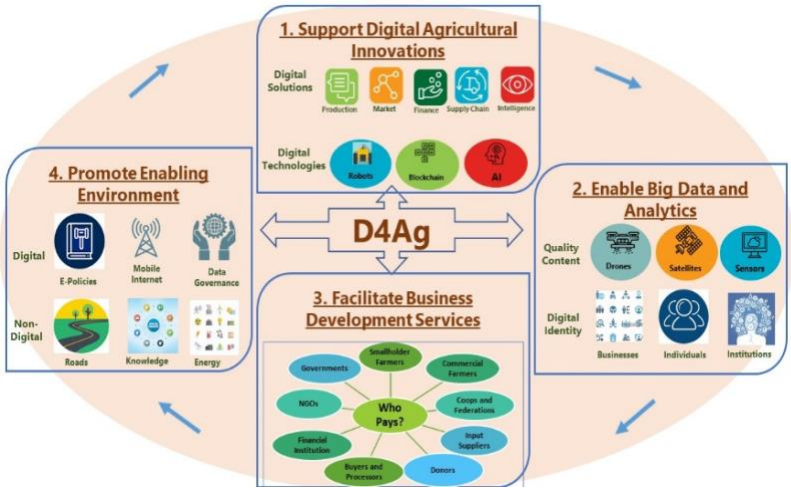

Figure 3: The digital agriculture framework (Addom, 2020) with the four pillars for analyzing digital agriculture

i) **Enabling environment** for digitalization which is about "the rules of the game" for digitalization, including digital/non-digital factors; and agricultural/non-agricultural factors like: infrastructure and access (digital infrastructure and hardware – mobile and internet networks, mobile phones), literacy and skills, policies and strategies, knowledge and networking, etc.

ii) **Data infrastructure**, consists of digital agricultural data infrastructure such as **"quality content"** derived from reliable soil maps, agronomic data, weather data, market data, etc., and **"digital identity"** covering data on users such as farmers, traders, consumers, research networks, extension networks, financial institutions, cooperatives, etc. This missing middle could be the game changer for agricultural production and trade through big data and analytics.

iii) **Digital innovations**, consisting of **"digital agricultural solutions/services"** such as advisory services, market linkage, financial access, supply chain/trade, etc., and **"digital technologies"** such as sensors, blockchains, drones, robots, mobile devices, that are required to operate, offer, and access the services/solutions.

iv) **Business development services** consisting of financing by donors and international development partners, investment by the private sector, business models support for the digital solutions, and issues relating to payment for the products and services to ensure future continuous adoption, scale, and sustainability.

The analysis of the digital agricultural ecosystem in Niger as presented below is thus based on the definition of Tsan et al. (2019) and the digital agriculture framework of Addom (2020).

[12] https://www.cta.int/en/digitalisation-agriculture-africa
[13] https://d4ag.com/about/

4.5.1 The enabling environment for digital extension and advisory services in Niger

For digital EAS to farmers to thrive, there should be an enabling environment that promotes development of digital platforms, tools and services as well as the adoption and smooth functioning of such digital solutions. Based on the digital agriculture framework presented earlier, five categories of enablers of digital agriculture, and for that matter digital EAS, can be identified. These include digital infrastructure and access, digital literacy and skills, policies and strategies, knowledge and networking, and business environment. This format is used to assess the enabling environment for digital EAS delivery and functioning in Niger.

a) Digital infrastructure and access

Mobile Network Coverage and Mobile Internet Connectivity

Almost all the major digital EAS providers (such as SIMA, SIMB, RECA) use IVR protocols and WhatsApp groups to engage with farmers across Niger. They also use their websites to disseminate classified agricultural information to farmers, other agricultural value chain actors and entities (e.g., national and international organizations) that provide EAS services to farmers (through implementing development projects), policy makers and researchers. RECA, for instance has a mobile app which is being deployed to support digital EAS delivery in the country. Access to these digital tools, platforms and/or services depend largely on good mobile network coverage. Simply, the absence of good network coverage is a key barrier to digital agriculture EAS delivery.

Mobile network operators with support from the government of Niger have worked to expand network coverage to a large part of the Nigerien population including the over 80 percent in rural areas where the bulk of smallholder farmers are resided. The Nigerien government has targeted 100 percent nation-wide mobile network coverage and 70 percent mobile penetration by the end of 2021 (GSMA/Deloitte, 2017). As of 2019, 92 percent of the Nigerien population has access to 2G network, while 3G has gathered momentum, rising from 10 percent in 2016 to a quarter of the population in 2019 (Figure 4). 5G is currently absent and 4G coverage is still in an infant stage.

Mobile penetration in terms of mobile ownership has been growing in Niger albeit slowly, with the rate in 2019 seven percent better than five years preceding (Figure 4). Despite the improvement in recent years, mobile phone ownership in Niger is still low relative to many countries in the Sahel. Mobile penetration in terms of unique subscribers, though lower in numbers compared with mobile ownership, has seen a more rapid growth, doubling from 18 percent of the Nigerien population in 2015 to 37 percent in 2019. In 2016, for instance, Niger had 5 million unique mobile subscribers representing 24 percent of the population (GSMA/Deloitte, 2017).

Basic phones are the most owned with limited adoption of smartphones, though smartphone adoption is also on the rise. There is a gender disparity in mobile ownership with women dominating ownership of basic phones while men have more access to feature and smartphones and can thus access more

digital services (Figure 4). The low adoption of smartphones could be an impediment for most farmers to access many of the digital EAS delivered through WhatsApp and mobile apps for instance.

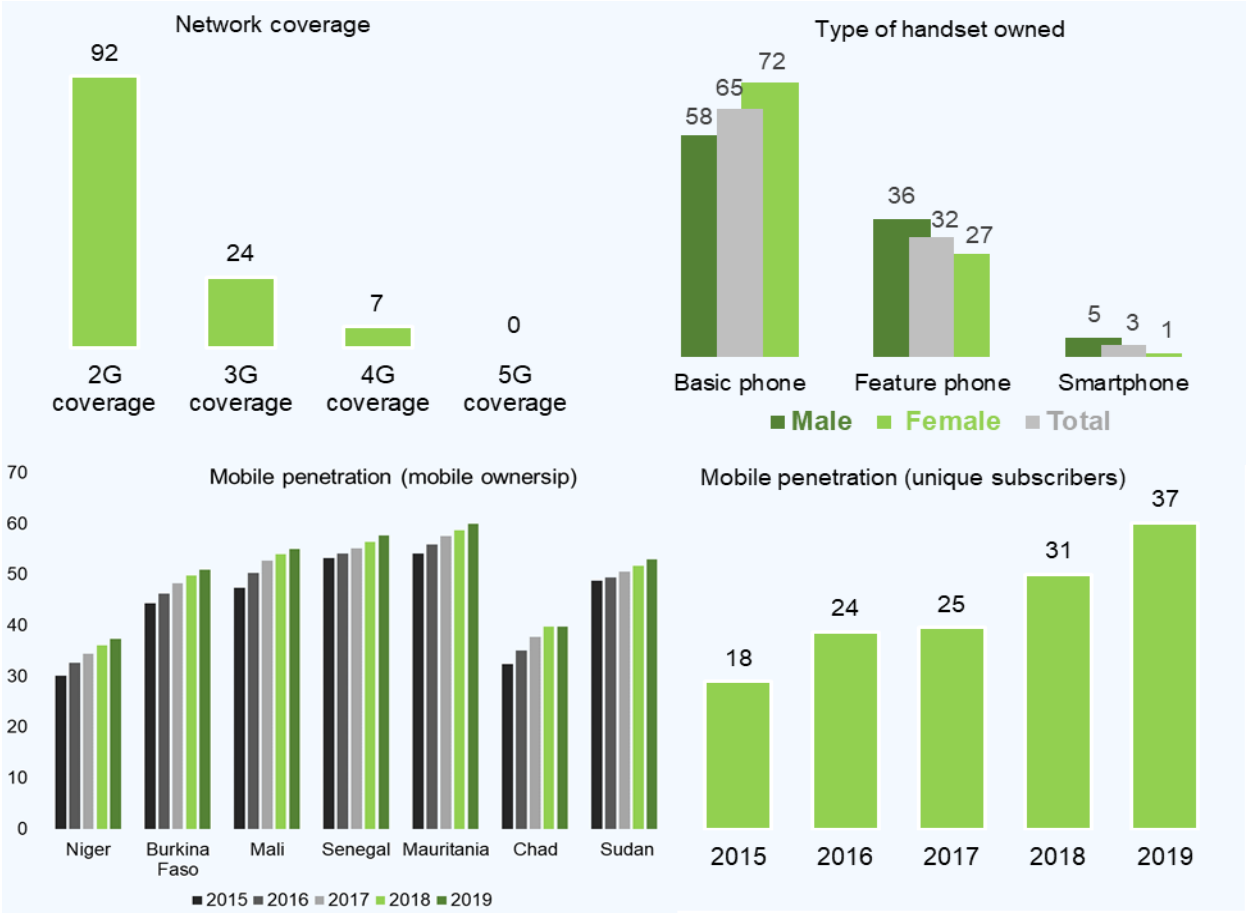

Figure 4: Mobile network coverage 2019, mobile penetration (ownership and unique subscriber rates) and type of handset owned by gender in 2015 in Niger. Data sources: network coverage (GSMA, 2020b); handset type (GSMA, 2015); mobile penetration (GSMA, 2016-2020b).

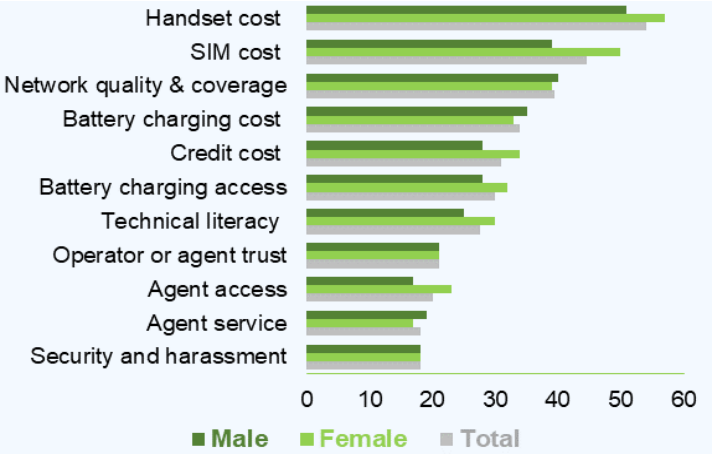

Figure 5: Barriers to mobile phone access and use by gender in Niger, 2015 (GSMA, 2015)

Many factors account for the low mobile penetration in Niger, and these also differ between men and women as displayed in Figure 5. Among them, handset and SIM costs, as well as network coverage and quality stand out as the main barriers. Despite these, mobile penetration in Niger is expected to increase rapidly. GSMA projection in 2019 (GSMA, 2020a) suggests that the unique mobile subscriber population in West Africa is likely to increase from 185 million (representing 40 percent of the West

African population) in 2018 to 248 million (representing 54 percent) in 2025. Nigeria will account for half of this projected 63 million new unique mobile subscribers, but that of Niger is estimated at 3.7 million, which is one of the fastest rates of expansion in West Africa only bettered by Ghana and Cote d'Ivoire (GSMA, 2020a). This is an indication of a growing appetite for digital services and with the current COVID-19 crises, there could be a hike in mobile penetration rate and desire for digital agricultural extension and advisory services.

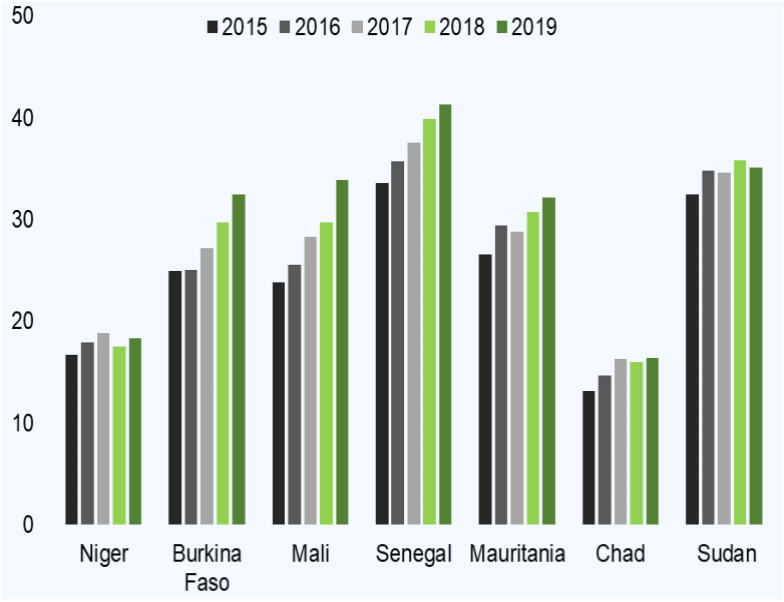

Figure 14: Mobile connectivity index scores over time in Niger and selected countries in the Sahel region (GSMA, 2020b)

A high internet connectivity is a necessity for access to many digital services. For instance, several of the digital tools or solutions being deployed in Niger to undertake digital EAS (WhatsApp groups, websites, mobile apps, etc.) require that users have access to adequate internet connectivity. However, as shown in Figures 6 and 8, Niger is the second least ranked country in Africa (only better than Chad) in terms of mobile internet connectivity as indicated by the 2019 Mobile Connectivity Index (MCI) score of 18.3 (GSMA, 2020b). Even though other countries in the Sahel region have seen sturdy progressive in mobile connectivity, Niger seems to have a slow and inconsistent progress especially since 2017 (Figure 6). It is thus not surprising to see that the mobile internet subscriber population or penetration rate in Niger is less than twice that of Mali, neighboring a Sahel country, and nowhere near many other countries in the Sahel and West Africa in general (Figure 7).

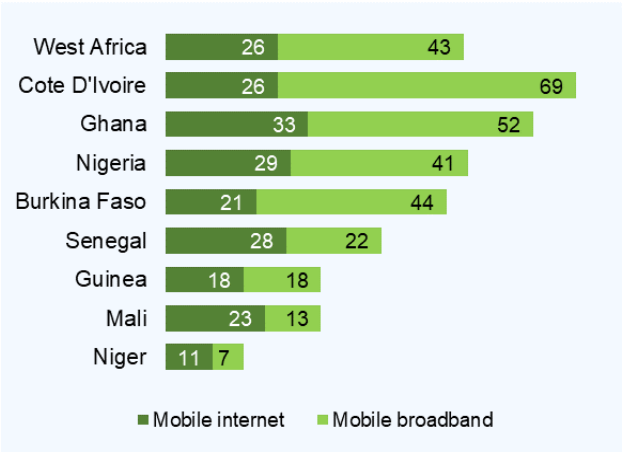

Figure 6: Mobile internet subscribers (% of population) in Niger and selected West African countries in 2019 (GSMA, 2020a)

The low mobile connectivity and slow advancement in Niger could be attributed to several factors, a collection of these is displayed in Figure 8. Affordability and consumer readiness appear to be, in relative terms, the strongest enablers of mobile connectivity in Niger yet they still lag behind many of the countries in the Sahel region. Affordability is enhanced largely by limited presence of inequality and favorable tax system, especially the Nigerien government's reduction in the taxes related to the total cost of mobile

ownership (TCMO) that occurred in mid-2017 (GSMA, 2017a). Mobile ownership and gender equality are the two biggest indicators of consumer readiness for mobile services adoption. That said, mobile tariffs, and most importantly, the cost of acquiring an entry level handset to access internet critically reduce affordability of mobile tools and services, and ultimately hinders progression of mobile connectivity. Many Nigeriens, particularly those in the rural areas consider the cost of mobile credit or data as prohibitive to obtaining mobile phones and connecting to the internet. For example, in 2019, the cost of a 500 MB (medium basket) and 1 GB (high basket) mobile data, respectively accounted for six and 15 percent of the monthly GDP per capita (GSMA, 2020b).

Digital infrastructure, and local content and services development remain the biggest obstacles to enhancing mobile connectivity and internet usage in Niger (Figure 8). Apart from mobile network coverage already discussed, most Nigeriens see the low quality and performance (e.g., mobile download speeds of 6.2 Mbps, and upload speeds of 8.5 Mbps) of the available mobile networks as reasons for holding back on the use of mobile internet.

Availability of content and services in the local languages in Niger is also a key challenge to increasing mobile internet connectivity (Figure 8). For instance, the number of active mobile apps developed per person has increased from 25 in 2015 to 38 in 2019 but in comparison with other West African countries, these are still on a lower side. Additionally, the number of such apps that have content and services in the local languages, which will best suit the taste and requirements of the large population with low literacy has remained low (around 10) within the same period (GSMA, 2020b). Some mobile internet users are also concerned about online safety and security, and a fear of exposing themselves to unwanted people or entities who could take advantage of them.

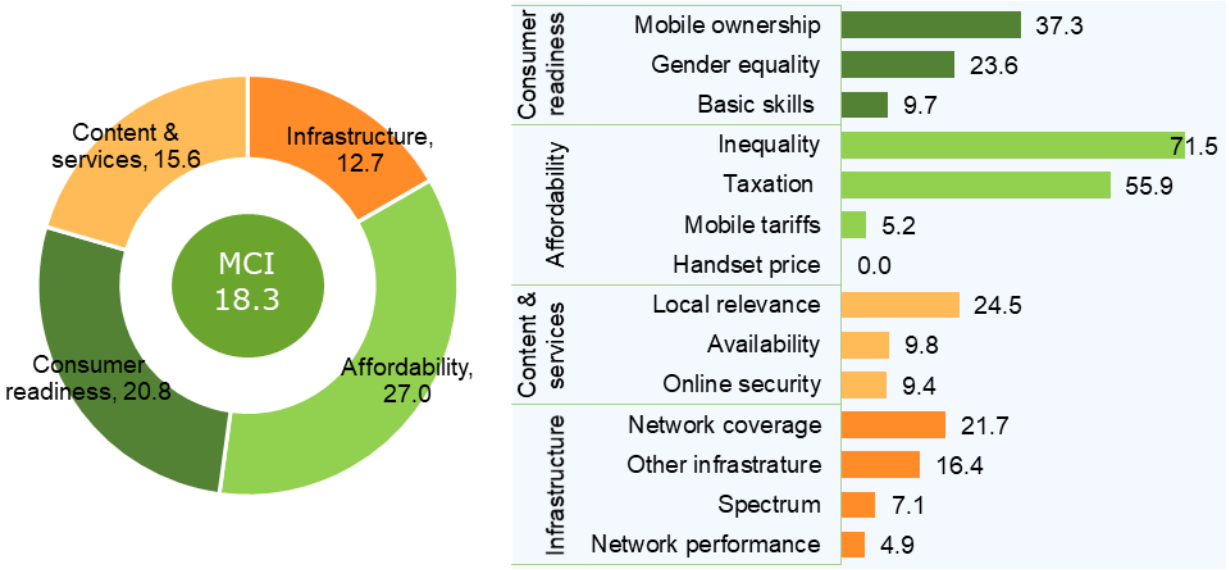

Figure 8: Mobile Connectivity Index (MCI) 2019, and the enabling factors with selected indicators for mobile connectivity in Niger (GSMA, 2020b). The data for the four enabling factors were measured on a scale of 0-100 with a higher value indicating a stronger performance of the indicator.

Electricity is one of the non-digital infrastructures that either enables or inhibits greater mobile penetration and internet connectivity. In Niger, the proportion of the population with access to electricity has continue to be low, and within the last five years (2015 to 2019), has stayed around 10 percent of the population (GSMA, 2020b). Much of this is accounted for by the urban population.

b) Digital literacy and skills

Technical or digital literacy is a pre-requisite for accessing and using various digital resources and services. In Niger, as previously shown in Figure 5, low technical literacy is seen as one of the principal barriers to adoption of mobile phones and internet usage, which in turn affects adoption of digital technologies and services. In Figure 9, the evolution of literacy rates among adult men and women and youth (both men and women) populations over time is presented. The data reveal greater literacy levels among men, both adults and youth, than women. The indication is that women farmers will generally have a weaker technical ability to explore or access and use digital solutions. The youth are also more literate than adults, which is a positive sign for an expected increased adoption of mobile and digital services owing to the more adventurous nature of youth, better awareness of and desire to explore such technologies and services.

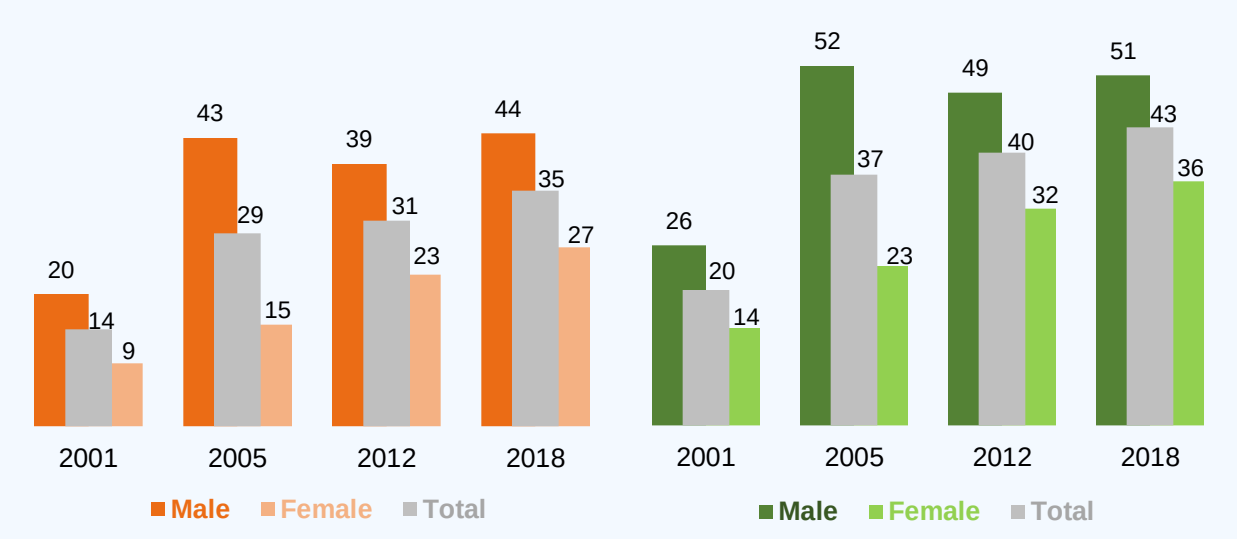

Figure 9: Literacy rate among adults (% of population aged 15 years and above, top left) and youth (% of population aged 15-24 years, top right) from 2001 to 2018 in Niger. Data source: UNESCO Institute for Statistics (http://uis.unesco.org/). Can also be sourced via the World Development Indicators, The World Bank (https://databank.worldbank.org/source/world-development-indicators).

The literacy levels among the different population groups in Niger is the second lowest in the Sahelian region as revealed in Figure 10. That notwithstanding, the rates have been increasing with time. This gives a positive outlook for the future and gives hope that a large share of the Nigerien population is likely to have an enhanced technical capacity for greater adoption and use of digital resources and services. The concern, however, is that the gap between men and women, both adults and youth seem not to be closing, but rather, has increased over time (Figure 11). This points to a possible larger gender disparity in technical literacy in the future and that could affect the prospect of empowering women towards the adoption and use of mobile and digital resources and services.

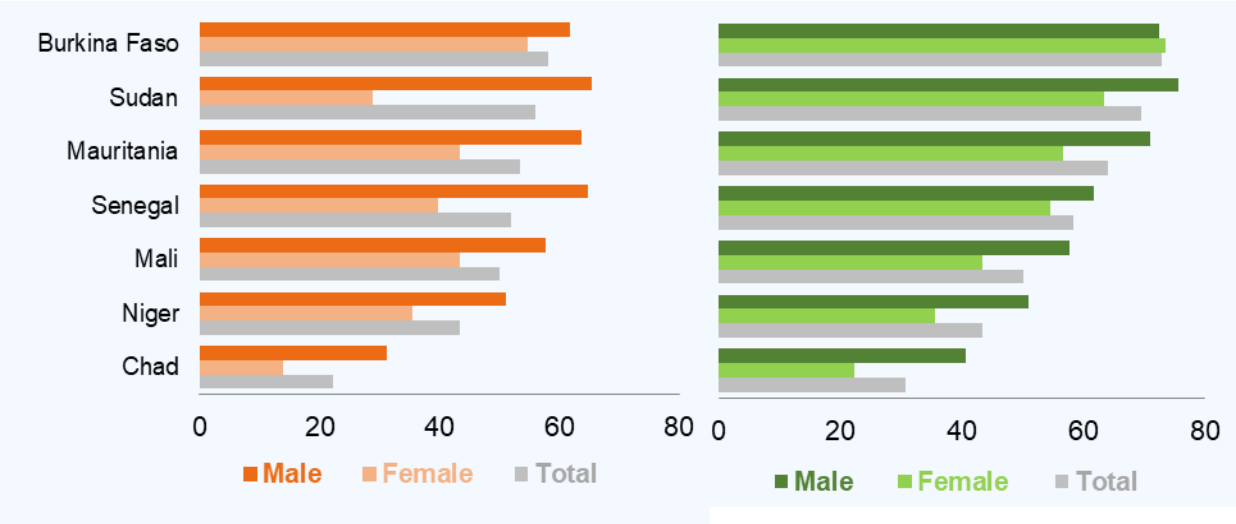

Figure 10: Literacy rate of adults (% of population aged 15 years and above, left) and youth (% of population aged 15-24 years, right) in Niger and selected Sahelian countries in 2018 (note: data for Senegal and Mauritania refer to 2017; and that of Chad refer to 2016). Data source: UNESCO Institute for Statistics (http://uis.unesco.org/). Can also be sourced via the World Development Indicators, The World Bank (https://databank.worldbank.org/source/world-development-indicators)

c) Policies and strategies

Digitalization is increasingly playing an important role in Niger's socio-economic development strategy. The government has created under decree No. 2017-621 / PRN of July 20, 2017 the National Agency for Information (ANSI) which is responsible for the implementation of the national strategy for universal access to ICTs as well as ICT development programs and projects throughout the country. In 2020, Niger launched the Smart Villages for Rural Growth and Digital Inclusion project funded by the World Bank to accelerate the adoption of digital technologies in rural areas. The project is targeted at increasing digital connectivity and improve digital financial services accessibility for 1.24 million people in more than 2,000 villages over the next 6 years.

The government through the Ministry of Agriculture and Livestock is also working closely with FAO to develop Niger's digital agriculture strategy.

As a youthful nation, the Niger government is supporting young innovators and youth-led businesses development in the digital area through annual competitions like e-Takara initiated by ANSI. To mitigate the economic impact of COVID-19 and identify effective digital solutions developed by young people that could be useful in any sector of the economy during this era of coronavirus pandemic, ANASI organized an online hackathon last year called Coronackathon.

Mobile taxation in Niger has improved in recent years. For instance, the amendment of the Finance Act by the Nigerien government in 2017 has led to reductions in mobile taxes. This has the propensity to increase mobile phone access by more than 500,000, increase 3G access by over 100,000 and create jobs for more than 4,000 people in Niger (GSMA, 2017a).

4.5.2 Data infrastructure for digital extension and advisory services

The agricultural data infrastructure available in Niger to support digital EAS are in Table 2.

Table 2: Snapshot of D4Ag infrastructure available in Niger to support digital EAS

Data category	Denomination/Data ownership	Description
Weather data infrastructure	• DMN	Rainfall forecasts (dissemination of rainfall data), dry sequences and the hydrological situation of rivers (rate of flow) are the major data collected and published by the DMN. Recommendations to farmers on how to cope with weather forecasts are also developed by DMN's experts. To support the data-based driven decision making by farmers, DMN through the Multidisciplinary Working Group works on decision support products like crops water requirement, frequency of irrigation, etc.
Market data infrastructure	• SIMA	SIMA collects weekly market data on 74 agricultural markets on: • Cereals: Millet, sorghum, maize, rice, paddy, fonio and wheat; • Tubers and derivatives: yam, sweet potato, cassava, gari (cassava flour); • Fertilizers: Urea, NPK; • Fruits: Pineapple, banana, lemon, date, guava, ordinary mango, grafted mango, orange; • Vegetables: Purple eggplant, carrot, apple, cabbage, cucumber, squash, fresh okra, Chili, fresh pepper, potato, table tomato, tomato sauce • Annuity products: Garlic, shelled peanuts, shelled peanuts, onion, white cowpea, red cowpea, dried peppers, sesame, large and small rhizome of Nutsedge, dried tomato.
	• SIMB	SIMB collects monthly market data on 115 livestock and meat markets on: • Livestock animals: Bulls, cows, heifers, calves, sheep, goats, camels, donkeys, horses and poultry. • Inputs for animal feed formulation: Peanut and cowpea tops, bush straw, bourgou (*Echinochloa stagnina*), salt, natron, cotton seeds, millet bran; • Animal leathers and hides; • Meats and offal; • Milk and eggs.
Soil maps	• Atlas of land use maps of Niger • Soil maps of some regions of Niger	

Agronomic data infrastructure	• FAO Crop calendar • FeSeRWAM • Availability of seeds and improved varieties and list of seed producers in Niger • Global list of pesticides authorized by the Sahelian pesticides committee	Data on sowing and harvesting periods of locally adapted crops in specific agro-ecological zones Agro-input data packages for cultivated varieties of millet, rice, maize, sorghum, peanut and cowpea (crop details, good agricultural practices and management, and other cultivation recommendations)
Agricultural training and education	Higher agricultural education institutions: • Higher School of Management, Law and Rural Development (ESIMAD) / Department of plant production, rural engineering • LAMI Private Agricultural Institute • Practical Institute for Rural Development • University of Diffa / Faculty of Agronomic Sciences • University of Maradi / Faculty of Agronomy and Environment • University of Niamey / Faculty of Agronomy • University of Tahoua / Faculty of Agronomic Sciences • University of Tillabéri / Faculty of Agronomic Sciences Secondary and vocational agricultural education institutions: • Agricultural high schools (Lami, Téra, Daoura) • Lami Agricultural Training Institute • Practical Institute for Rural Development (IPRD) • Technical and Vocational Training Centers (CFTP)	
Research networks	• Regional Center of Agro Hydro-Meteorology (AGRHYMET) • African Center of Meteorological Applications for Sustainable Development	

	• Famine Early Warning Systems Network • International Crop Research Institute for the Semi-Arid Tropics (ICRISAT) • National Agricultural Research Institute of Niger (INRAN) • Abdou Moumouni University (UAM) • National Council for Agronomic Research (CNRA) • International Livestock Research Institute (ILRI) • CORAF/WECARD	
Data infrastructure on farmers	• POs • RECA	200,000 to 250,000 farmer members RECA has profiled more than 24,000 farmers benefiting EAS through the e-extension program.

4.5.3 Digital innovations for extension and advisory services in Niger

The online survey involving digital agriculture and agricultural development experts revealed that a host of D4Ag solutions is available within the digital landscape of Niger and other West African countries that can be deployed for EAS delivery to farmers in Niger. Some have their headquarters in Niger (e.g., Labaroun Kassoua; Tele-Irrigation, E-KOKARI); some in West Africa (e.g., Espace Geomatique – Burkina Faso; Agriculture-Sol-Eau – Togo); while others are headquartered outside Africa (e.g., Viamo (3-2-1) – USA; AfricaFertilizer – USA). Also, some are state owned, and others are private digital solutions or platforms.

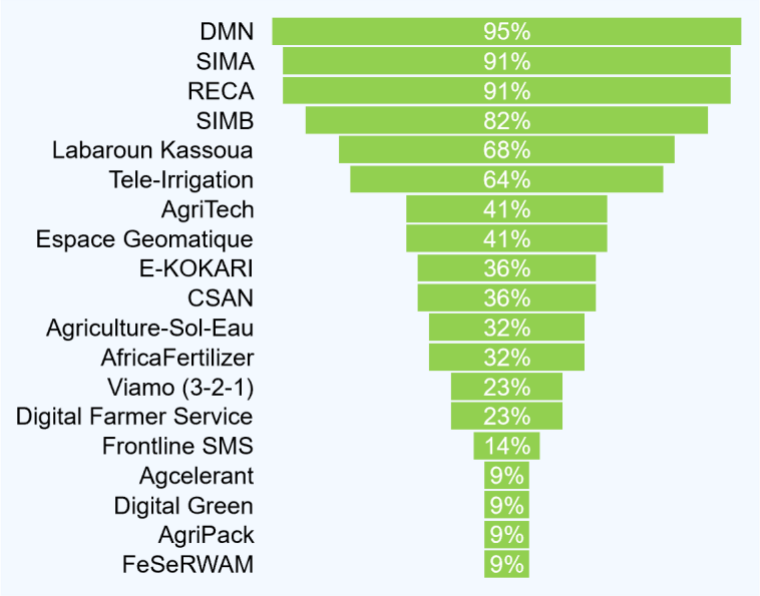

Figure 11: Share of experts who are aware of each digital solution/platform/system to support digital EAS to farmers in Niger

The view of the digital agriculture and agricultural development experts' as shown in Figure 11 suggests that the state-owned systems (DMN, SIMA and SIMB) are more popular than the private ones, except the e-Extension system of RECA which is highly popular in Niger. The four most prominent digital EAS platforms or systems (DMN, SIMA, RECA's e-Extension Program and SIMB) all have nationwide coverage, provide specialized but bundled digital services via a diversity of digital

tools and in multiple languages - French and local languages (Annex 1a). The data available in Annex 1a and 1b suggest that the digital platforms or systems are still relatively young (most launched within the last five years), but each has a relatively large number of farmers and other agricultural value chain actors accessing their services. With digital EAS rendered free of charge to farmers (except for the CSAN platform), these platforms or systems have the potential to attract more farmers and expand their reach. However, the low digital literacy and poor digital infrastructural development remain crucial impediments.

Apart from the top four digital EAS platforms or systems mentioned above, Labaroun Kassoua, Tele-Irrigation, Agritech, Espace Geomatique, E-KOKARI and CSAN also appear reasonably known and being used by farmers or being deployed by development projects to support EAS to farmers in Niger.

The D4Ag solutions are at different stages of deployment. Some are relatively well established – RECA, SIMA, SIMB, DMN, others have a gradually growing user population and are being scaled-up (e.g., Tele-Irrigation, CSAN), while others are still in pilot stages (e.g., E-KOKARI) but with great potential to support EAS (Annex 1a and 1b). The opinion of the experts indicates that some digital solutions such as Digital Green, AfricaFertilizer.org (AFO), Agcelerant, and AgriPack seem to have limited patronage or only have presence in Niger and are currently not being actively deployed to support EAS delivery.

Description of the top four digital EAS platforms/systems in Niger

RECA's e-Extension Program

RECA's e-Extension program combines a call center, a radio program, WhatsApp groups, Facebook pages (RECA-Niger and RECA-phyto), voice and text messages through a Messaging Pro platform, a mobile application « *Renforcement du Conseil Agricole* » and a website. The program was developed and implemented based on the e-Extension program of Côte d'Ivoire established by the National Rural Development Support Agency (ANADER). The RECA program is being implemented with the model presented in Figure 12.

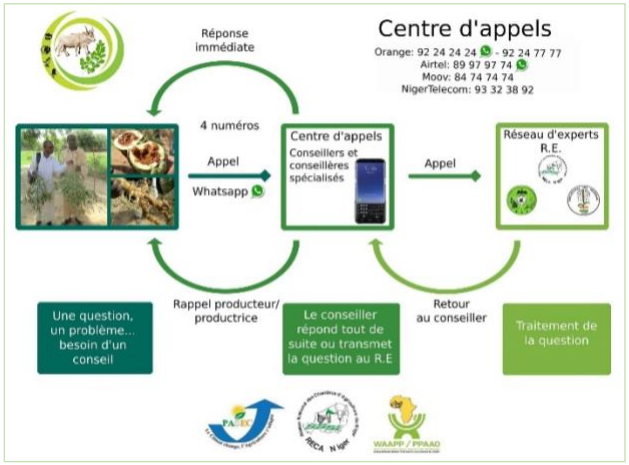

Figure 12: RECA's e-extension model (RECA, 2018)

The Call Center: The Call Center for remote EAS is the first of its kind in Niger. It operates from 8:30 AM to 5:30 PM from Monday to Friday, and in French, Hausa, Tamashek, Fulfulde and Zarma. It has the advantage of operating with all the four mobile phone networks in Niger. It provides the necessary remote advisory support to farmers within a relatively short timeframe to help them make the right decisions to improve their agricultural practices and production. In 2020 for instance, the Call Center received nearly 14,000 calls (265 calls per week), including 213 calls on WhatsApp (80

percent) and 52 through normal phone calls (20 percent). This represents an increase of 40 percent compared with 2018. Most of the information requested by farmers focus on crop protection, market prices of vegetables, inputs (fertilizers, seed access and quality, etc.) and animal health. A special call number has been created by the CRA in Zinder since 2018 to better inform farmers about funding opportunities and financial services access.

Figure 15: WhatsApp group of farmers from the Tahoua region

WhatsApp Groups: As part of the Call Center program, RECA has created 22 WhatsApp groups spread over all the regions and linked to the Call Center, with 110 agricultural extension agents and technicians involved. Farmers do not only use the WhatsApp groups to receive information or ask specific questions from the call center, but also use the groups as a platform to engage with each other, share information and experiences. For example, a farmer who participated in a training used their WhatsApp group to provide feedback on the training using photos and voice comments.[14] The WhatsApp groups allow farmers to make quick diagnosis of pests and diseases by sending photos and voice recordings to explain the problem and seek advice. RECA uses WhatsApp groups to broadcast weekly voice messages in Hausa and Zarma on prices of the main cereals (millet, sorghum, and rice) and share weather forecasts and short radio programs.

Radio program: RECA produces radio programs of 13 to 14 minutes on issues regularly faced by farmers. In the Dosso region for instance, extension agents host live radio sessions to respond to farmers' questions after a radio broadcast. Also, during meetings, extension agents listen to radio broadcasts on their smartphones with farmers and engage in discussions afterwards.[15]

Mobile application: In September 2019, RECA developed its mobile application named 'Strengthening of Agricultural Advice (*Renforcement du Conseil Agricole)'* with financial and technical support from the Technical Centre for Agricultural and Rural Cooperation (CTA). The mobile app (Figure 14) is a set of learning content in different forms (audio, technical notes, radio podcasts, field activities in photos and text) for extension agents and farmers. The voice contents available in Zarma and Hausa languages are mainly targeted at farmers

Figure 14: A snapshot of RECA's mobile app

[14] https://reca-niger.org/IMG/pdf/dispositif_e-extension_reca_et_cra_2019.pdf
[15] https://reca-niger.org/IMG/pdf/dispositif_e-extension_reca_et_cra_2019.pdf

while written contents target the extension agents. The application which is available for free on Play Store and can be used without internet, has received over 1,000 downloads.

Facebook pages (RECA-Niger[16] and RECA-phyto[17]): These two pages have more than 21,500 followers and allow RECA's e-Extension services to reach people, especially the younger population who are more tech-savvy. For example, this post of a young farmer in the region of Tiribi presenting the advantages of a new variety of banana on one of RECA's Facebook page sparked a large engagement in November 2020: +2,000 likes, 128 comments and 158 shares. The RECA-phyto page has been launched as a platform to provide advises on the main crop pests and diseases in Niger and discuss control methods. The page has several posts on climate-smart agriculture techniques.

RECA website: RECA's website[18] is a major component of the e-Extension platform. The website regularly publishes SIMA and SIMB bulletins and reports on agricultural product prices. It also contains useful information from various stakeholders in Niger, the sub-region and more than 150 technical notes and reports.

SMS and Voicemail: RECA uses a 160-character format SMS and a 30 second voice message format in Hausa, Zarma and French languages to provide production advisory services to farmers (e.g., advice on pre-sowing seed treatment, desiccation of mango trees, safety procedures in handling pesticides, etc.).

RECA's e-Extension program has extended its services to breeders with the Livestock Call Center (CA-El) started in September 2020 and operating at present in the regions of Dosso and Tahoua.

The Livestock Markets Information System (SIMB)

The Livestock Markets Information System or SIM Livestock of Niger is a specialized digital service of the Ministry of Agriculture and Livestock. Placed under the Directorate of Statistics of the Ministry, SIMB is responsible for monitoring market prices of livestock products (e.g., meat, milk) and inputs (veterinary products, etc.). It has a mandate of improving knowledge on the mass of livestock traded on the markets, the numbers sold, and the prices per livestock species.

SIMB collects specific data on the main livestock animals (e.g., bulls, cows, heifers, calves, sheep, goats, camels, donkeys, horses and poultry.) The information is disseminated through radio, press releases in French, Hausa and Zarma, and through several briefs and reports (flash info, monthly and campaign briefs, annual reports). In January 2021, SIMB has collected market data in 108 livestock and meat markets in Niger and 7 cross-border markets.

The National Directorate for Meteorology in Niger (DMN)

DMN publishes weather alerts through bulletins and daily briefings. The dissemination to farmers is done through national TV and radio.[19] DMN also produces an agro meteorological bulletin.

[16] https://www.facebook.com/recaniger
[17] https://www.facebook.com/recaphyto
[18] https://reca-niger.org/
[19] https://p4arm.org/app/uploads/2019/05/PARM_Niger_Feasibility-study-on-information-systems_Sept2018.pdf

The Agricultural Market Information System (SIMA)

The Agricultural Market Information System (SIMA) of Niger is a specialized service of the Ministry of Trade and Promotion of the Private Sector. It was created in 1989 and data collection activities began in 1990. SIMA tracks around 40 agricultural products including cereals (millet, sorghum, maize, paddy rice and wheat), cash crops (garlic, peanuts, onions, cowpeas, etc.), fruits, vegetables, and tubers in 66 markets in Niger. It also tracks eight cross-border markets. SIMA operating budget is provided by the Nigerien State except for assessments of some 20 target markets funded by the Famine Early Warning Systems Network (FEWSNET) and the World Food Programme (WFP).

The market data collection and verification processes are structured as follows:

- Investigators collect the information on paper questionnaires at the market level. They then send the questionnaire at departmental level by post.
- The departmental manager checks the information of the various investigators, update them if necessary, validate them, and send them to the regional coordinator.
- The regional coordinator does a new check and forwards the questionnaires to the national level.
- The national SIMA unit receives and digitalizes all data contained in the questionnaires.

The information collected is processed and disseminated on national radio in three languages (French, Hausa and Zarma) and through several bulletins, which are published on the SIMA and RECA websites:[20]

SIMA is currently regularly producing the following bulletins:

- The monthly bulletin of the agricultural market analyzes the demand and supply and presents prices of cereals and annuity products.
- The weekly cereal bulletin presents the price situation on the cereal markets.
- The Fruits and Vegetables weekly bulletin analyzes the prices of fruits (e.g., lemons, bananas, oranges) and vegetables (e.g., cabbages, peppers, tomatoes) recorded each week on the markets in 12 cities.
- A monthly bulletin on food security Albichir, Produced by SIMA, WFP and FEWSNET.

The Center for Food and Nutrition Security (CSAN Niger)

CSAN provides a paid tailor-made advisory service by phone to anyone interested in investing in the agri-food sector but has minimal knowledge of the sector. Through its website[21], CSAN shares useful news and resources like SIMA's and SIMB's monthly agricultural market bulletins.

4.5.4 Business development facilities for digital extension and advisory services

One of the key challenges for the limited adoption, use and scale of digital solutions for agriculture results from the business models behind the platforms. The development and deployment of the

[20] https://p4arm.org/app/uploads/2019/05/PARM_Niger_Feasibility-study-on-information-systems_Sept2018.pdf
[21] https://www.csan-niger.com/

solutions thrive on income. For sustainability – a factor that determines continuous use and scale – there must be investment through some means after the initial financing mainly by donors, foundations, and international development partners. Our assessment considered the business development issues including models of financing, models of investments, and the entrepreneurial landscape of digitalization of agriculture in the region. In other words, who pays for these services, since smallholder farmers are generally not willing or able to pay for extension services driven by digital innovations.

Majority of the EAS in Niger are provided free of charge to farmers and are functional in the context of development projects. The number of markets covered by SIMB and SIMA varies depending on the availability of funding which usually comes from external donors. RECA's e-extension program is currently implemented within the framework of the Climate-Smart Agriculture Support Project (2016-2022) funded by the World Bank and the West Africa Agricultural Productivity Project.

These funding mechanisms do not guarantee sustainability of the D4Ag solutions, the adoption and scaling. As an illustration, SIMB was funded by USAID between 1988 and 1991. The end of USAID support which happened in 1991 affected the operation of SIMB. For almost a decade the service was sluggish, and the number of markets covered had significantly dropped from 50 to 25 until recently. SIMB and SIMA are jointly funded by the Niger state and the European Union.

A pilot business model based on the cost of SIM card is currently being implemented by RECA, Viamo and Airtel. Farmers must pay for one Airtel SIM card to access available EAS information developed by RECA on an IVR implemented in Niger by Viamo. This model may generate an increase in subscription for Airtel and farmers may also pay for other services provided by Airtel like normal phone calls, data and SMS.

The results of a survey conducted by Novatech during the pilot phase of E-KOKARI have shown that farmers are willing to pay for a service that respond to the specific problems they are facing. For its implementation phase, E-KOKARI will use a business model based on the cost of phone calls. Farmers will have to pay only the cost of a call to access E-KORARI's services. While these two business models seem to be beneficial and affordable for farmers, they do not guarantee the sustainability and the profitability of services in the long-term.

In partnership with RECA, Orange Niger launched Labaroun Kassoua in 2011, an agriculture market information service that provided information to farmers through SMS, USSD and IVR technologies. Despite the interest expressed by farmers (over 8,000 regular unique users a year after the launch), the service has not been highly successful over the years due to its incapacity to generate business profit and the poor coverage of Orange Niger in rural areas.

4.6 Effectiveness of digital extension and advisory systems and services

4.6.1 Accessibility of the digital EAS platforms

As already indicated, the Nigerien population is characterized by low digital literacy and limited mobile network coverage. Based on these, particularly in rural Niger where majority of smallholder farmers and other agricultural value chain actors live and work, digital and agricultural development experts

were asked to indicate the extent to which the services of each of the prevailing EAS platforms and systems are accessible to farmers and the other actors. The results are presented in Figure 15, and show that RECA's e-Extension program, SIMA, SIMB and the DMN systems are more accessible even in the face of the low digital literacy, network coverage and limited access to electricity. RECA's e-Extension program seems the most accessible among the four. This is given credence by the view of an expert working with a civil society organization:

"The RECA platform, I find it relevant, because with new technologies including telephone support, the advisory services are accessible to producers. Also, with SIMA, a farmer visiting a market is informed through the radio about the prices of agricultural products, which allows him/her to take a decision on this or that market according to what it represents".

On the other hand, CSAN (which renders paid EAS to farmers), as well as Espace Geomatique and FeSeRWAM platforms both headquartered outside Niger, are viewed by experts to have low accessibility. Perhaps, they are not known much by many farmers and other actors. One expert gave an opinion on this and lamented that:

"There are innovation platforms in Niger which I think are very useful but unfortunately, they are little known or not known to the public. We must somehow think of a synergy of actions …"

	Highly accessible	Accessible	Somehow accessible	Inaccessible	Highly inaccessible	
SIMB	45%	18%	9%	5%	0%	Accessibility based on digital literacy
SIMA	45%	23%	9%	0%	5%	
RECA	50%	32%	14%	0%	0%	
Espace Geo	0%	0%	23%	5%	32%	
CSAN	0%	23%	27%	0%	14%	
DMN	18%	45%	14%	0%	5%	
FeSeRWAM	0%	0%	23%	5%	18%	
SIMB	9%	59%	14%	0%	0%	Accessibility based on network coverage
SIMA	9%	59%	14%	0%	0%	
RECA	18%	64%	14%	0%	0%	
Espace Geo	0%	5%	27%	9%	18%	
CSAN	0%	27%	23%	9%	5%	
DMN	5%	45%	27%	5%	0%	
FeSeRWAM	0%	9%	9%	9%	5%	

Figure15: Experts' opinion on the accessibility of the main digital EAS platforms/systems based on digital literacy levels and mobile network coverage in Niger

Feedback from farmers using the RECA, SIMA, SIMB and DMN systems echoed the opinion of the experts that the platforms and systems are indeed accessible. However, this depended largely on the digital tool used to deliver the extension and advisory services to the farmers. Radio was cited by many

farmers as the digital tool mostly used to access the needed services. Access to electricity (which is low by the way) could be an obstacle than digital literacy and mobile network coverage in this regard. Some farmers also mentioned access to the EAS via tools such as WhatsApp, call center and IVR that require literacy and network coverage. Even though 3G and 4G networks are limited in Niger, more than 90 percent of the population has access to 2G mobile network which can make it possible to access those digital tools. Additionally, it is possible that training of farmers by public and private agricultural extension agents, and national and international organizations through implementation of development projects have helped to improve the technical capacity of farmers to use such digital tools.

4.6.2 Ranking of the digital platforms based on participation of youth and women

More than 80 percent of the Nigerien population is engaged in agriculture. Women make up about half of this agricultural population and engage in activities along the agricultural or commodity value chains (e.g., processing, marketing, or trading of agricultural products – both crop and livestock) (NEPAD, 2012). On the other hand, Niger has a youth population that constitutes a large part of the agricultural labor force. It is thus essential that the prevailing digital EAS platforms/systems are responsive to the specific requirements of these population groups, to attract them, enhance their participation and benefits from accessing those platforms/systems. In view of these, the experts were asked to rank the main digital EAS platforms based on their knowledge of them – knowledge of technologies used, services, etc.). As it was the case with accessibility, RECA's e-Extension program came up as the top ranked digital EAS system for participation and benefit by women and youth (Figure 16).

	Average rank value	Rank	
RECA	2.1	1	Youth
SIMB	2.3	2	
SIMA	2.4	3	
DMN	2.7	4	
CSAN	3.2	5	
Espace Geo	3.6	6	
FeSeRWAM	3.6	7	
RECA	2.4	1	Women
SIMB	2.6	2	
SIMA	2.8	3	
DMN	2.8	4	
CSAN	3.0	5	
FeSeRWAM	3.3	6	
Espace Geo	4.1	7	

Figure 16: Friendliness of digital EAS delivery to allow participation and benefit of youth and women farmers, ranked on a scale of 1 to 5 with 1 being best

The reasons for this are not immediately clear. However, for the youth, the more trendy and interactive tools used by RECA (e.g., WhatsApp, Facebook pages, IVR, voice SMS, and mobile app) may have contributed as youth are more attracted to social media platforms and emerging technologies. Nigerien women are less literate than men, hence the use of IVR and voice SMS protocols, apart from TV and radio programs, could suit their situation better. These partly explain why most experts rate RECA's system as more responsive to youth and women. As one youth farmer in Agadez region simply puts it:

"I am only aware of services provided by RECA's e-Extension system", and another youth in Niamey particularly mentioned the *use of RECA's mobile app*.

A female farmer in Tahoua region voiced that RECA's e-Extension system, *"promotes agricultural fairs and shows in Tahoua and strengthens the synergy between RECA and the Tahoua Regional Chamber of Agriculture"*.

These assertions seemingly point to more visibility, proximity, and complementary services provision of RECA's system, which can attract youth and women. This view is shared by some of the experts. For instance, an agricultural development expert working with a diplomatic organization in Niger stated that:

"Significant efforts are being made, but very little communication and visibility efforts, a very important aspect for a better understanding of the different platforms, useful for target groups, and for strengthening of advocacy to accompany their operations"

4.6.3 Usefulness of the content and services of the EAS platforms

Figures 17 and 18, respectively show the opinion of experts on the extent of usefulness of the content and services provided by several digital solutions being deployed for EAS in Niger, and whether the content and services delivered meet the needs of farmers and other actors. The experts' opinion (Figure 17) suggests that RECA's e-Extension program, SIMB, SIMA, DMN and Tele-Irrigation provide really useful content and services. However, the RECA's e-extension program is deemed to provide the best content and services evidenced by almost two-thirds of the experts rating RECA's content and services as being 'extremely useful'. One expert posits that:

	Extremely useful	Useful	Somehow useful	Not useful	Extremely not useful
SIMB	41%	36%	9%	0%	0%
SIMA	41%	36%	9%	0%	0%
RECA	64%	23%	9%	0%	0%
Espace	5%	27%	18%	0%	0%
CSAN	18%	18%	14%	0%	0%
DMN	41%	36%	14%	0%	0%
FeSeRWAM	5%	14%	9%	0%	0%
Viamo (3-2-1)	14%	14%	0%	0%	0%
Digital Farmer Service	9%	9%	0%	0%	0%
Digital Green	5%	9%	5%	0%	0%
Agcelerant	0%	9%	5%	0%	0%
Labaroun Kassoua	32%	14%	5%	5%	0%
AgriPack	9%	0%	5%	0%	0%
Tele-Irrigation	50%	14%	5%	0%	0%
Espace Geomatique	18%	5%	0%	0%	0%
Agriculture-Sol-Eau	23%	0%	14%	0%	0%
AfricaFertilizer	14%	18%	0%	5%	0%
E-KOKARI	18%	9%	0%	0%	0%
Frontline SMS	14%	5%	0%	0%	0%
AgriTech	9%	14%	5%	0%	0%

Figure 17: Experts opinion on the usefulness of the content and services provided by the different digital platforms/systems for EAS delivery in Niger

"The e-extension system of RECA seems to me to work quite well, meeting a real need of farmers and advisors. The combination of WhatsApp groups, call centers, the website... seems to me to work pretty well"

For the state-owned platforms (SIMB, SIMA and DMN), an expert with one of the farmer organizations indicated that:

"… for the state-owned platforms, it is important that they make improvements in the services offered, mainly by using social networks and other digital tools".

The experts had a bit of a divided opinion about the Agriculture-Sol-Eau platform as 23 percent judged the content and services provided as extremely useful while 14 percent had a neutral stance.

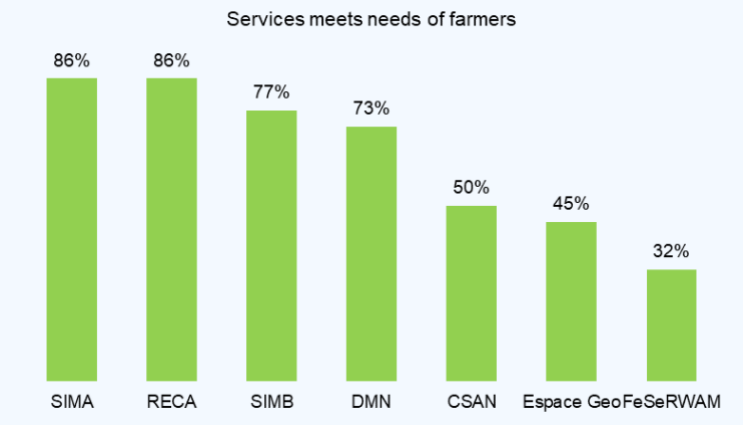

Figure 18: Share of experts that agree that the content and services provided by each digital EAS platform/system meets the needs of farmers in Niger

Remarkably, more than two-thirds of the experts think that the content and services provided by the top four digital EAS platforms/systems, RECA, SIMA, SIMB and DMN, meet the requirements of the farmers and other users to a large extent (Figure 18). Even more interestingly, the farmers' feedback corroborates the opinion of the experts that the content and services delivered are of sufficient quality and match their respective needs.

In terms of sustainability of the digital EAS platforms/systems and their services, both the experts' opinion and farmer feedback agree, that the systems are sustainable. However, considering that all the four main digital platforms/systems provide free extension and advisory services to farmers, sustainability of each will depend the on the source of funding. This view is summarized by one expert as follows:

"I have some doubts about the sustainability of funding for SIMB and SIMA"

"I am more confident about the sustainability of RECA's e-Extension funding. RECA and the CRAs are becoming key players in extension/advisory, are increasingly recognized by donors and the state, and I doubt that donors will stop supporting the RECA/CRA programs in the coming years. If the system continues to show relevance, effectiveness, and efficiency, the RECA e-Extension system will find funding from donors. On the other hand, we should gradually introduce financing mechanisms less dependent on external aid (contribution from the relevant sectors for example, and state endowment)".

4.6.4 General perception on the effectiveness of the digital EAS platforms

The effectiveness of the main digital platforms in delivering quality EAS to farmers and other value chain actors was analyzed considering diverse factors including the type of digital tools being deployed

for what extension/advisory service, accessibility, inclusiveness and the quality/usefulness of services rendered. Based on these factors, the experts gave their general perception on each platform's effectiveness (Figure 19). The results suggest that RECA, SIMB, SIMA and DMN, the four principal platforms are as effective as they can be in delivering digital EAS to farmers and other actors in Niger. The assessment of the general effectiveness of each digital platform followed the same trend as the other dimensions discussed above – RECA's e-Extension program appearing relatively more effective. Additionally, the results suggest that the objectives of setting up each of the digital extension platforms are generally being achieved.

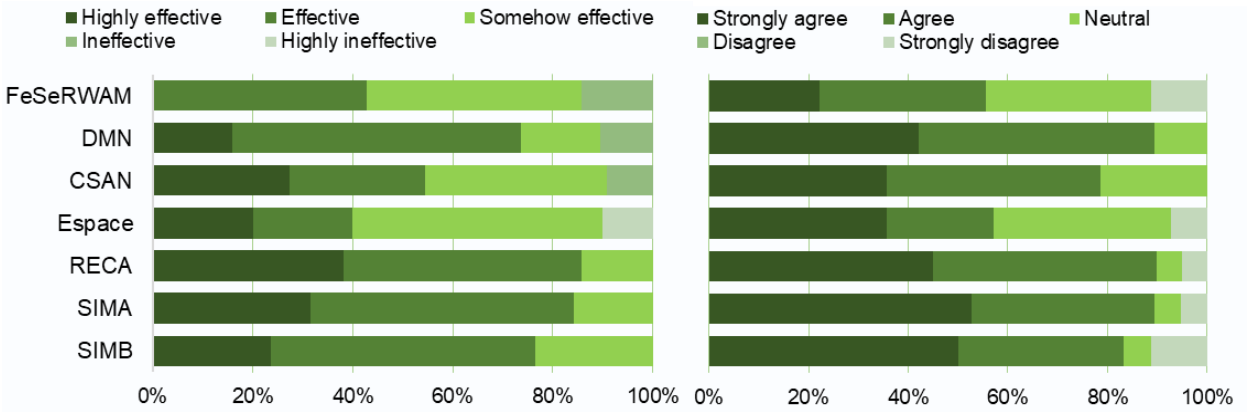

Figure 19: Perception of digital agriculture and agricultural development experts on the effectiveness of the main digital EAS platforms (left), and the extent to which they agree that the objectives or mandates of setting up the platforms are being achieved (right)

The experts' verdict gives a positive outlook on the quality of the content and services being delivered, and of the effectiveness of the digital extension and advisory platforms in delivering services that match the needs of farmers and other actors in Niger. Feedback from farmers indicates that the experts' verdict is reliable. However, the farmers' feedback indicates that they require improvements in some of the current services, as well as need additional services and digital tools to serve diversified needs. With respect to that, some of the farmers and the experts (that responded to the online survey) who have accessed the services of the dominant digital EAS platforms in Niger provided feedback (Table 3).

Table 3: A snapshot of feedback from farmers and experts who have used the four dominant digital EAS platforms/systems in Niger

Digital platform	Farmer feedback
All platforms/systems	• For the services delivered to be effective, voice messages should be used more regularly • There should be popularization of technologies or services in the national languages as that is most appropriate and effective. • There should be active collaboration and networking between the different platforms/systems, and synergy building for complementary services delivery and benefits to farmers • Radio is the more accessible tool to reach rural farmers in Niger • Low literacy rates remain a constraint: literacy allows farmers to learn

SIMA	• Should consider providing information on the market prices of vegetables • The radio shows should be more regular
SIMB	• Should consider using social media to reach a larger audience • The information provided should be shared regularly through the radio programs • Should consider covering more or all the markets in Zinder region
RECA	• The RECA mobile application should be updated regularly • It is necessary to have extension agents available to visit us from time to time, especially when the internet connection is not good • Should promote agricultural fairs and shows in Tahoua region and strengthen the synergy between RECA and the Tahoua Regional Chamber of Agriculture • We heard about the RECA app and the WhatsApp groups but because we do not have android phones, we cannot access them • I do not think cost, digital literacy or digital infrastructure are the biggest problems. It seems to me that it takes above all good facilitators / moderators, both at the level of RECA/CRA (to facilitate the exchanges for example, to propose content, to seek answers, etc.) and in the villages to relay to the farmers. • The call center, WhatsApp groups and the radio programs seem to me the most effective for farmers. • The RECA website is probably one of the best on West African peasant agriculture (perhaps the best?), but is it useful for producers? It is useful for PO leaders, executives, technicians, consultants, students, researchers, etc.
DMN	• Radio programs should be more interactive by involving producers and answering their questions. It is mainly the rainfall forecasts that interest producers. • DNM should work closely with the farmer organizations as the leaders can help further disseminate weather forecasts to farmers across Niger. The content should also be in basic terms and in a language easily understandable by farmers. • A call center would be helpful

5. CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions

- The current COVID-19 pandemic has seemingly reduced the effectiveness of the traditional EAS due to restrictions on mass gatherings. However, the study revealed that extension and advisory services are being rendered by both public and private actors to farmers. Low coverage of farmers by extension agents and limited coordination and collaboration among EAS providers have lowered the potential benefits.
- Digital EAS have become more important and could be a game changer for smallholder farmers, other agricultural value chain actors and development practitioners in Niger – a possibility to access or deploy digital tools for quality EAS from the comfort of their homes, fields, marketplaces, and offices.
- Mobile penetration (mobile phone ownership and unique mobile subscribers) is on the rise and Niger is projected to have one of the fastest rates of increase of mobile penetrations in West Africa by 2025.

- Low literacy level, limited network coverage (both gradually improving) and low access to electricity are obstacles to access and use of digital tools, but the outcome of the study indicates that their impact on the accessibility of the available digital platforms is not huge.
- Niger has reasonable digital agriculture infrastructure to support delivery of digital EAS. The agricultural data infrastructure including content and user data is in the hands of the individual service providers. Development of agronomic, weather, soil, market data and farmer databases can be said to be scattered and duplicated. There appear to be no leadership or coordination of this important infrastructure.
- The private owned e-Extension system of RECA and the state-owned digital platforms such as SIMA, SIMB and DMN are the more dominant, accessible and effective platforms which provide quality content and services that match the specific needs of farmers. RECA's e-Extension program appears to be the most accessible and effective, with numerous digital tools and services that suit the situation of diverse farmers.
- While difficult to validate the sources of initial financing of digital agricultural extension activities in the country, it may appear to be driven by donors and international development partners. There are few private sector players with varied business models that are still at the teething stage. The sustainability of the digital platforms is therefore not clear due to the current dependence on international organizations and donors for funding of operations.

5.2 Recommendations

a) General recommendations

- Pluralism should provide synergies and complementary services which would have been useful to serve the diversified needs of farmers. But this requires leadership at national level to coordinate the ecosystem of service providers for increased innovation and equality of access to underserved communities.
- To unleash the potential of digitalization for agricultural extension and improve the agri-food sector through a sustainable and inclusive digital revolution, a series of actions must be taken at different levels to support the digital agricultural ecosystem, improve dialogue and collaboration between stakeholders, implement policies that foster the adoption of digitalization across value chains and enhance digital connectivity nationwide.
- Making agronomic data, soil maps, weather data, market data among others available to digital entrepreneurs will be fundamental in fostering youth-led digital innovation for agriculture. Research institutions like INRA and the Ministry of Agriculture and Livestock have a significant responsibility in improving collaboration with digital innovation centers. This calls for a national leadership in building a resilient agricultural data infrastructure in collaboration with other stakeholders.
- Ensuring continuous capacity building to facilitators and moderators of state-owned and private digital EAS providers is crucial for quality remote digital advice to farmers, the development of relevant content, and better transfer of knowledge with lead farmers who are playing a significant role in areas where extension agents are unable to reach.

- As part of its responsibility to coordinate extension and advisory activities, the SNCA has a key role to play in mobilizing relevant stakeholders to develop and implement sustainable financing mechanisms for agricultural extension that minimize the dependence on donor funding. A phased approach in which donors and international development partners de-risk the digital innovations through grants, loans, subsidies; then the government provides the necessary enabling environments; and then the private sector comes into scale could be explored.
- The SNCA must also lead the development of a national smallholder digital identity database – based on farmer's data already collected by RECA, POs and related entities. Such a database would allow for the provision of precise and targeted advisory messages to farmers, avoid farmer's data duplication among digital EAS providers and facilitate banks and other financial institutions to support farmers with insurance, loans or credit. The outcomes yielded by the Agri Edenred program in facilitating access to quality inputs through a fair, transparent and smart digital payment solution in three pilot regions in western Niger have demonstrated the multiple advantages of farmers' digital identity.

b) Specific recommendations

Recommendation on sharing of specific extension and advisory information. Table 4 includes recommended digital extension platforms that can be used to share information on agronomic and other practices.

Table 4: Recommended digital extension platforms for iREACH to share information on agronomic practices, soil, weather, and livelihoods.

Innovation / information to share	Recommended platform
Agronomic practices	RECA's e-Extension program
Soil / fertilizer information	RECA's e-Extension program
Weather information	DMN, RECA's e-Extension program
Market information	SIMB (livestock products); SIMA (crop products)
Livelihoods	RECA's e-Extension

Although RECA's e-Extension program does not collect market data directly, the various channels deployed by the program to reach smallholder farmers throughout Niger can also be used to share such information.

Recommendation on strengthening of the available digital EAS platforms. The digital extension typology adapted by Davis et al. (2018) classifies the key functions of agricultural extension into six steps:

- Diagnosis – Determine problems faced by farmers that will be addressed by the extension and advisory intervention.
- Awareness – Bring awareness to farmers about improved agricultural practices.
- Persuasion – Convince farmers to try new agricultural practices.
- Teaching – Teach farmers good agricultural practices.
- Reminding – Remind farmers what they have learned.
- Feedback – Get feedback from farmers on what they do not understand and additional information they need and adapt accordingly.

The typology also takes into consideration the various digital tools for extension and advisory services provision to determine the most appropriate tool to provide the necessary information to farmers at a particular step. Based on this, the following recommendations are proposed to help strengthen some useful digital EAS platforms existing in Niger.

Table 5: Recommendations to strengthen the extension platforms, tools, approaches and services in Niger based on the digital extension typology.

Extension Steps	RECA's e-Extension program	Viamo (3-2-1)	CSAN
Diagnosis	Improve the mobile application: Update and diversify the content format (add videos), classify the content per language; include a shortcut that link to the call center and include a section on frequently asked questions by farmers by region, per crop and livestock species.	Include interaction between farmers and AE experts	Team capacity building on diagnostic approaches Adoption of appropriate channel(s) to reach farmers in rural areas
Awareness	Produce videos. Access agriculture videos may be a great alternative in the case of high production cost.	Ensuring the production of radio programs on various themes by taking into consideration current challenges faced by farmers	
Persuasion	Introduce videos		Produce audio and video content
Teaching	Plan regular field visits/Demonstrations and provide smartphones or tablets to extension agents for group viewing	Develop audio programs in local languages that clearly explain step by step good practices	
Reminding	Integrate reminder messages on crop cycle, agro-meteorological information, pest and disease management, etc.		
Feedback	Implement feedback and mechanism with farmers.	Profile farmers Implement feedback and interaction mechanism with farmers.	Profile farmers Implement feedback and interaction mechanism with farmers.

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7. ANNEXES

ANNEX 1

Annex 1a: Summary information on the four most popular and widely accessed digital EAS platforms or systems in Niger.

Name	SIMA	RECA's e-Extension Program
Public/Private	Public	Private
Launch	ODK (Open Data Kit) – 2016 SIM2G (Second Generation Market Information System) – 2018 SIAR (Regional Agricultural Information System) – 2020	Website – 2010 Call center – 2017 Mobile app – 2019
Description	- A specialized digital service under the Ministry of Trade and Promotion of the Private Sector. - SIMA tracks around 40 agricultural products in 80 markets in Niger and tracks ten cross-border markets. - Information collected is processed and disseminated on national radio in French, Hausa, and Zarma, and via several bulletins.	- RECA's e-Extension Program was developed and being implemented based on the e-Extension program of Côte d'Ivoire developed by the National Rural Development Support Agency. - RECA's e-Extension Program combines a call center, a radio program, WhatsApp groups, mobile application, Facebook pages, voice and written text messages through the Messaging Pro platform, and a website.
Digital tool(s) used	IVR, radio, WhatsApp, website	Call center, direct SMS & voice messages, IVR, WhatsApp, radio, mobile app, website, Facebook
Coverage	Nation-wide	Nation-wide
Access/Reach	- Large number of individual farmers. - **Eight (8)** farmer organizations, cooperatives and grassroot groups.	Call center – 10,000 farmers WhatsApp – 15,000 farmers Radio – 250,000 Mobile app – 1,300 subscribers Website – 700 visits per month
EAS provided	Market linkages and information	Production advisory services, market linkages & access, financial services, collaboration & networking
Service type	Bundled service	Bundled service
Subscription type	Free	Free
Languages	Multiple	French, Hausa, Zarma, Tamashek, Fulfulde
Challenges	Access costs, digital infrastructure	Access costs, digital literacy, digital infrastructure
Status	Active	Active
URL	http://simaniger.cilss.int/	https://reca-niger.org/spip.php?mot3

	SIMB	CSAN
Public/Private	Public	Private
Launch	2019	2017
Description	- SIMB is a digital service of the Ministry of Agriculture and Livestock, under the Directorate of Statistics. - It monitors and collects data on market prices of livestock and livestock products and inputs in 78 markets in Niger and 7 in Nigeria. - The data or information collected are disseminated through radio programs, press releases and briefs.	- CSAN is digital system that provides tailor-made advisory services at a fee through phone calls to farmers and other value chain actors interested in getting specific knowledge or information. - CSAN disseminates other useful information and resources the monthly bulletins of SIMA and SIMB via its website.
Digital tool(s) used	IVR, WhatsApp, radio, website	Direct SMS, IVR, WhatsApp, website
Coverage	Nation-wide	Nation-wide
Access/Reach	- 3,000 farmers and other actors - 50 farmer organizations, cooperatives and grassroot groups	- 7,500 visitors per month for the website - 600 to 700 farmer organizations and agricultural enterprises
EAS provided	Production advisory services, market linkages and information	Production advisory services
Service type	Bundled service	Bundled service
Subscription type	Free	Paid service
Languages	Multiple	Multiple
Challenges	Digital infrastructure	Digital infrastructure, language barrier
Status	Active	Active
URL	https://simbniger.cilss.int/	www.csan-niger.com

Sources: Survey data, websites of the digital platforms

Annex 1b: Summary information on other popular D4Ag solutions being deployed to support digital EAS delivery to farmers in Niger.

Name	Labaroun Kassoua	Tele-Irrigation
Ownership	Orange	Tech-Innov
Yead Launched	2011	2013
Description	- Provides real-time advisory services regarding market prices of crop and livestock products in more than 70 markets in Niger via USSD, SMS, and interactive voice responsive (IVR) protocols. - **Over 8,000 unique as of 2012**.	- Remote irrigation control with a phone - The Tele-Irrigation system is installed with a custom solar-powered pump connected to a mobile app. Farmers then program the system for specific watering times and durations based on the type of crop and its water needs and can initiate irrigation with a mobile phone. - **Over 200 farmers** using the technology.
Technologies	SMS, USSD, IVR	IOT, IVR, Mobile app, SMS
Use cases	Market linkages, advisory services	Supply chain management
Languages	French, Hausa	French, Hausa
Drawback	Business model	Subscription costs

Stage	Inactive	Scaling
URL	http://www.orange.ne/labaroun.html	http://www.tele-irrigation.net

Name	**Agritech**	**E-KOKARI**
Ownership	Itech Center	NOVATECH
Year Launched	2018	2017
Description	- Agritech is a mobile and web networking platform for urban and rural agricultural stakeholders. - Besides its operational e-commerce service (AgritechShop), Agritech supports farmers with training on crop and livestock management and provide an exchange space for farmers and agricultural experts to interact and cross-share knowledge and experiences. - Data gathering and analytical services for farmers and other actors. - Information sharing, weather alerts, etc. - **125 farmers & 4 farmer organizations** using the technology	- An IVR platform that allows farmers, breeders, traders, etc., to access real-time information, advice, warnings, and market prices of crops and livestock. - Provides voice recorded information in Hausa and Zarma that users can access based on their needs via dialing a short code on their phones. - Monitoring of presence and activity of pests without the need for regular crop inspections; accurately manages the supply of inputs; and provides image recognition of over 120 pests and diseases to farmers. - Provides soil fertility status and a recommendation adapted to the nutritional needs of targeted crops.
Technologies	Mobile app, website platform	AI, Sensors, Geospatial imaging, IVR
Use cases	Collaboration and networking	Advisory services, market linkages
Languages	French	French, Hausa, Zarma
Drawback	Services currently covering only **one region,** Niamey	N/A
Stage	Scaling	Pilot
URL	https://agritech.live.ne/agritech	http://www.novatech.ne

Name	**Espace Geomatique**	**Viamo (3-2-1)**
Ownership	Espace Geomatique SARL	Viamo
Year Launched	2016	2010
Description	- Allows for agricultural and environmental resources monitoring and precision agriculture support. - Offers services in urban planning and natural resources management. - Provides advisory support services. - Conducts studies and program evaluations on natural resources, hydrology, agro-pastoralism.	The 3-2-1 Service delivers free agricultural information developed by RECA to farmers on mobile devices.
Technologies	Drones, GPS, Remote sensing, Satellite	Call Center hotline, IVR, push SMS services

Use cases	Advisory services, Market linkage, Data systems	Advisory services
Languages	English, French	French, Hausa, Zarma, Tamashek, Fulfulde
Drawback	Regulations and rules for the operation of drones	Services currently available only for Airtel Niger subscribers
Stage	Scaling	
URL	www.espace-geomatique.com	https://www.viamo.io/fr/services/le-service-3-2-1/

Name	**Agriculture-Sol-Eau**	**AfricaFertilizer**
Ownership	Agriculture-Sol-Eau	IFDC
Year Launched	2016	2010
Description	- This solution provides specialized advisory services on agronomy, irrigation, and renewable energies. - Irrigation advice is given considering the soil and the physiological needs of the crops; fertilizer application advice by regular monitoring of the physical characteristics; and advisory on timely detection of crop diseases and pests.	Provides information on national and international inputs prices. The web- and mobile phone-based AMITSA system utilizes both private and public sector agro-input stakeholders to collect and process market data on prevailing wholesale prices of the most common fertilizers, seeds and CPPs.
Technologies	AR, Big data, Drones, Machine Learning, VR	Web platform, Mobile app
Use cases	Financial services	Macro agri intelligence, market information
Languages	English, French	English, French
Drawback		
Stage	Pilot	Scaled
URL	https://www.facebook.com/agriplusarltgd	https://africafertilizer.org/

Source: CTA D4Ag database, and websites of the digital platforms

ANNEX 2

Recommended national digital service providers that can help with digital capacity building of farmers and implementation of digital services. Contact information available from the authors on request.

Service provider	Type
SME Incubator Centre of Niger (CIPMEN)	Digital innovation hub and tech startup incubator
National Agency for the Information Society (ANSI)	Government
Fondation Hirondelle	Media

ANNEX 3

List of experts that participated in the online surveys/interviews. Contact information available from the authors on request.

S/N	Organisation
1	Representative from Agriterra Niger
2	Representative from SIMB
3	Representative from CSAN
4	Representative from Hystra
5	Representative from Novatech
6	Representative from RECA (1)
7	Representative from Itech Center
8	Representative from Ministry of Agriculture and Livestock
9	Representative from Vsf-Belgique Niger
10	Representative from SIMA (1)
11	Representative from Agadez Regional Chamber of Agriculture
12	Representative from RECA (2)
13	Representative from National Institute of Agronomic Research of Niger (INRAN)
14	Representative from SIMA (2)
16	Representative from Tahoua Regional Chamber of Agriculture
17	Representative from International Crops Research Institute for the Semi-Arid Tropics (ICRISAT)
18	Representative from FAO
19	Representative from Institut de Recherches et d'Applications des Méthodes de développement
20	Representative from Fédération des Coopératives Maraichères du Niger (FCMN-Niyya)
21	Representative from Ministry of Agriculture and Livestock
22	Representative from ONAHA
23	Representative from Espace Geomatique