Review of Digitisation Work Carried Out by the CASA Programme

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Commercial Agriculture for Smallholders and Agribusiness

The Commercial Agriculture for Smallholders and Agribusiness (CASA) Programme aims to drive global investment for inclusive climate-resilient agri-food systems that increase the income of smallholder farmers.

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ACRONYMS

Agri-VAS	Agriculture Value Added Service
AI	Artificial Intelligence
AMCOS	Agricultural Marketing Co-operative Societies
B2B	Business-to-Business
CASA	Commercial Agriculture for Smallholders and Agribusinesses
CBA	Cost-Benefit Analysis
CCE	Climate Change and Environment
CTEVT	Council for Technical Education and Vocational Training (Nepal)
ERP	Enterprise Resource Planning
FCDO	Foreign, Commonwealth and Development Office
FNS	Food and Nutrition Security
FYM	Farmyard Manure
GESI	Gender Equality and Social Inclusion
GIZ	German Corporation for International Cooperation
HS	Himalayan Supervores
IoT	Internet of Things
KII	Key Informant Interviews
KPI	Key Performance Indicator
LMICs	Low- and Middle-Income Countries
MEL	Monitoring Evaluation and Learning
MNO	Mobile Network Operator
MSD	Market Systems Development
NA	Not Applicable
SaaS	Software as a Service
SME	Small and Medium Enterprise
TA	Technical Assistance
TAF	Technical Assistance Facility
VSLA	Village Savings and Loan Association

EXECUTIVE SUMMARY

The integration of digital interventions into the Commercial Agriculture for Smallholders and Agribusinesses (CASA) programme provides a positive example of adapting and responding to business needs 'in flight'. Digitisation has been part of CASA's interventions from the early days of the programme, despite not being an explicit objective reflected in its original theory of change or monitoring and evaluation framework. Adoption of digital technologies has been prompted by requests from agribusiness partners, reflecting a demand-led approach.

Commissioned by FCDO, this review adds to discussion of how digitisation can support agribusinesses and smallholder farmers in the development of market systems, assessing how digital technologies were "naturally" integrated into the technical assistance provided by CASA. It considers 14 digitisation activities with 12 partner businesses: nine agribusinesses and three mobile-based agriculture Value Added Service (agri-VAS) companies. CASA's responsive delivery of digital technical assistance led to observations of benefits and challenges, leading to lessons learnt and recommendations for CASA and other comparable programmes to get digital transformation in the agri-food sector 'right'.

Benefits & Challenges

1 Without structured indicators and targets, it is difficult for programmes to measure the impact of digital interventions and to gauge their effectiveness.

2 The value of digital investments can be compromised by cost, stage of investment (readiness) and geography which may disproportionately affect women's ability to access, afford and use them.

3 With investment-ready partners seeking to strengthen smallholder engagement, CASA digital interventions were predominantly 'Advisory and information services' and 'Supply-chain management services'.

4 There are challenges of costs and financial sustainability for agri-VAS.

Lessons Learnt

1 Address impact evaluation through setting specific indicators to measure and report impacts on efficiency, costs and adaptation to climate change.

2 Digital technical assistance for agribusinesses should be needs-driven and inclusive, and leverage available solutions.

3 Certain digital interventions are more needed and affordable than others e.g. advice and info (environmental standards, pests, weather) and supply-chain management (productivity, timely payments, reduced crop loss). To reach smallholders, "digital champions" (intermediaries) and pilots with end-users should be used.

4 Digital technical assistance should initially be co-financed by programmes to assess long-term sustainability.

Recommendations

1 **Include meaningful project-level key performance indicators on digital technologies** – focus on measuring impact, with dedicated monitoring, evaluation and learning. For agribusinesses focusing on enhanced efficiency, reduced operating costs, and climate adaptation; for agri-VAS focusing on impact at farmer level and on financial sustainability.

2 **Meet businesses where they are** – start intervention planning by assessing business needs, technological readiness to adopt digital solutions, in-house and financial capacity to use them, availability and selection of service providers, and accessibility for women.

3 **Build capacity and raise awareness on digital technologies** – support training of agribusinesses on best practices for gathering, storing and sharing user data; and promote cross-learning among agribusinesses using and/or providing digital technologies.

4 **Consider trade-offs** – Understand the return on investment for digital technologies compared to 'traditional' interventions, implement cost-benefit analyses, and plan for financial sustainability and for covering costs after the project's end.

To support these programme-level recommendations, presented at the end of the paper are further recommendations for FCDO and other donors designing market sector development programmes, including: considering digital technologies from the outset, analysing digital transformation projects to inform design, incorporating digitisation key performance indicators, and ensuring budget support for impact evaluations.

INTRODUCTION

FCDO's Commercial Agriculture for Smallholders and Agribusiness (CASA) programme (100% funded by UK International Climate Finance) supports small and medium-sized (SME) agribusinesses with smallholder supply chains to grow and attract investment for high development impact. CASA aims to build inclusive, climate-resilient agri-food systems that increase smallholder farmer incomes and where possible strengthen smallholder adaptation and resilience to climate change, and food and nutrition security outcomes, in priority countries.

CASA has three components, two of which (Components A and C) are managed by NIRAS in partnership with Swisscontact. Component A is demonstrating high impact interventions in the four target countries (Ethiopia, Malawi, Nepal, and Rwanda) leading to mobilisation of investments for partner agri-businesses, and to improvement of food production and quality to enhance food and nutrition security. Component B (managed by Technoserve) is the technical assistance facility, referred to as CASA TAF, working alongside investors to deploy inclusive technical assistance that strengthens upstream supply chains of partner SMEs, promoting returns, development impact and resilience. Component C is a learning and knowledge-sharing component for upscaling and replication of CASA activities, collating evidence and drawing learnings from across CASA Components A and B. The CASA crosscutting priorities are climate change and the environment (CCE), gender equality and social inclusion (GESI), and food and nutrition security (FNS).

Digitising[1] specific services and activities in agricultural value chains can provide smallholder farmers and agribusinesses with growth opportunities due to reduced costs and improved efficiencies, particularly when accessing information, finance and markets. However, the actual impact of a digitally-based intervention does not depend on the technology used, but on the service provided using that technology, as highlighted by an earlier CASA evidence review (CASA, 2020). Previous research also highlights that in integrating digital technologies to support the investment readiness of agribusinesses, it is important to understand the motivation for the use of digital technologies by identifying where the demand for digitisation is coming from (from the agribusiness or donor-pushed), understanding the typologies of agriculture value added services (agri-VAS) available, and assessing their suitability for meeting the business needs of agribusinesses (CASA, 2020; Schulz, 2021).

This paper was commissioned by FCDO to examine how the CASA Programme has considered and used digital solutions and mobile-based agri-VAS to support its interventions. The findings build an understanding of common threads – and lessons learned – running through the CASA experiences, comparing these with examples from other similar digitisation-in-agribusiness programmes, and with references to the literature, to draw out best practice, and what CASA could have done, or do better, in future. The paper also explores the challenges and opportunities (both realised and missed) of integrating digital solutions as part of the technical assistance (TA) provided to agribusinesses. It should be noted that the digitisation activities reported in this paper exclude digital technologies already in use by agribusinesses prior to CASA's intervention, such as the use of M-PESA for mobile payments in Kenya[2].

The findings of this paper will contribute to the knowledge base on the role of digitisation in supporting agribusiness to become investment ready, and to use digital tools to help SMEs engage with smallholders, as well as to inform further CASA interventions and future FCDO market systems development (MSD) programmes.

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[1] The process of using digital technologies to convert analog text, pictures or sound into a digital form that can be processed by a computer.
[2] Supported by Shell Foundation/FCDO

METHODOLOGY AND LIMITATIONS

This paper has used the following methodologies for data gathering:

- **Primary data collection** from Component A[3] and CASA TAF[4] through online questionnaires and key informant interviews (KIIs) for data validation.
- **Secondary research** based on representative literature in the field of digitisation in MSD programmes.

The research adopted an iterative approach (i.e., presenting outputs of each step to all parties concerned for feedback and revision) with CASA Component A and CASA TAF throughout the process of data collection, analysis, and reporting (see Figure 1).

The analysis in this paper of the digitisation work of the CASA Programme is based on self-reported data from Component A and CASA TAF. So far there have been no published reports from the programme or any MEL analysis of CASA's digitisation work. Most

of the digitisation interventions reported are still in the early stages (as shown in Tables 2 and 3) and as a result, there is not yet any data on their impact at agribusiness and household levels, in terms of improved efficiencies, cost savings or other benefits of using digital technologies.

Concerning the cost of CASA's digitisation interventions to date, as much information as was available at the time of writing this report is provided. Additionally, there have been no formal cost-benefit analyses (CBA) carried out, though there is one now ongoing by CASA TAF of its work with DeHaat (see Annex 3). It should be noted, however, that cost-benefit considerations are part of the business planning stage to inform decisions and options before any intervention or investment is put in place, and that there are project justifications in intervention proposals that feature CBA-informing numbers. (For a clear con-
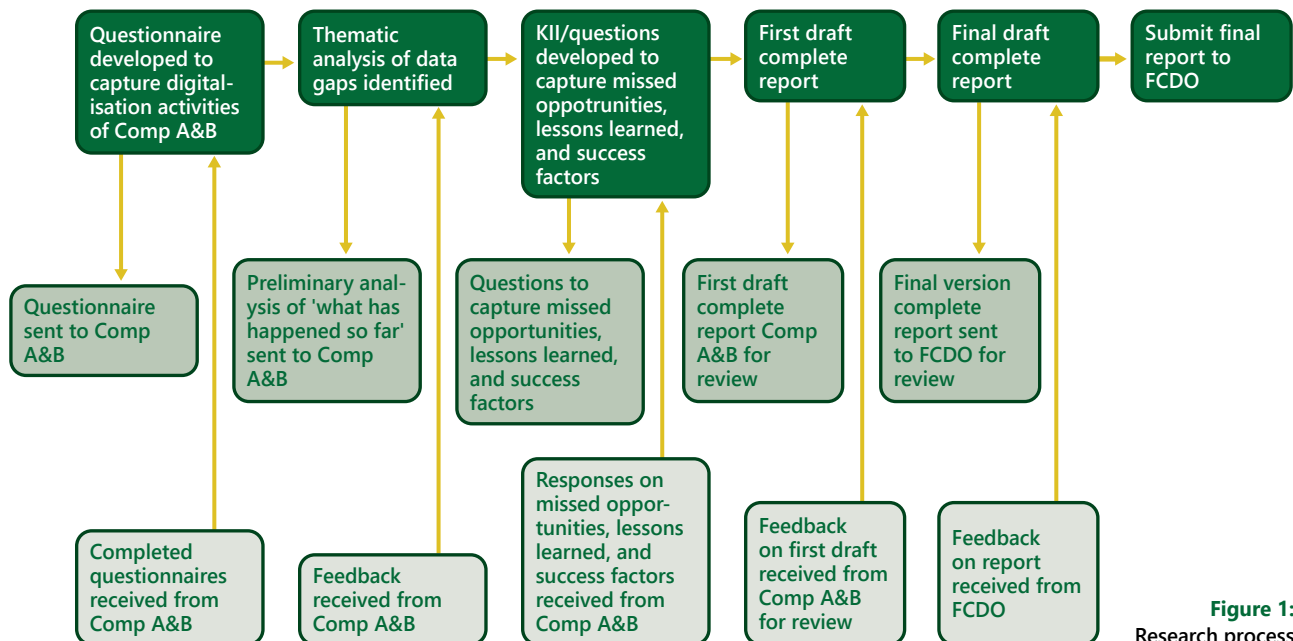
Figure 1:
Research process

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[3]   Component A is CASA's market systems development component delivered by NIRAS and Swisscontact.
[4]   CASA TAF (or Component B) is CASA's global technical assistance facility, delivered by TechnoServe.

sequence of high cost being a deterrent to digitisation, see the Malawi example in the section on challenges and missed opportunities, below.)

This review of the adaptive and demand-led digitisation work carried out by the CASA Programme provides a retrospective foundation for needs assessment (including cost-benefit analysis), programme design and implementation, and a robust monitoring, evaluation and learning approach. It demonstrates how – even though digitisation was not central to CASA's original design – the programme responded to partner-assessed needs and requests for support. The analysis follows on from earlier CASA research (2020) that with foresight considered six main types of digital agri-VAS services (Table 1), identifying which of these describe the support eventually provided by CASA to agribusinesses (Table 2) and agri-VAS (Table 3).

Table 1: VAS categories with SME agribusiness as main clients *(source: CASA, 2020)*

Category	Description
Advisory and information services	Information and advice on good agronomic practices, pest and disease diagnosis and management, market prices, weather forecasts, and more-sophisticated digital advisory services.
Market linkages	Platforms that link smallholders to farm inputs, to services for production and post-harvest machinery and mechanisation and to off-take markets – including agri-dealers, wholesalers, retailers, and end-consumers.
Financial access	Services that facilitate the creation and integration of digital payment services, digital credit, and insurance services into existing market operations, thereby engaging stakeholders that are financially excluded from conventional financial services.
Supply-chain management	Business-to-business services that facilitate the management of smallholder relationships and operations for agribusinesses and other value chain stakeholders.
Macro-agricultural intelligence	Services that provide tools for decision support and data analytics that incorporate multiple sources of information on smallholders, farms, and markets converted into insights for making informed business decisions.
Super platforms (Value chain integrated services)	Comprehensive end-to-end solutions that incorporate advisory and information services, market linkages, financial access, supply-chain management, and macro-agricultural intelligence.

DIGITAL TECHNOLOGIES IN AGRICULTURAL MSD PROGRAMMES

Agricultural MSD programmes aim to improve market operations by creating an enabling ecosystem for agricultural value chain actors, and to foster long-term agricultural development (Onumah et al., 2007). There are three main approaches used by agricultural MSD programmes that apply digital technologies, either as bundled services[5] or as individual services for digitising specific aspects of the value chain (Woodward, 2019; Schulz, 2021). These are:

1. **Advisory and information services** to address information asymmetries in agricultural markets and support farmers to adopt good agricultural practices that build their climate resilience. These interventions include the provision of information like market prices, weather forecasts, and alerts on pest and disease outbreaks.

2. **Market linkages** to enhance access to agricultural inputs and outputs. These interventions help overcome spatial and temporal restrictions to trade, reduce the cost incurred in accessing physical marketplaces, strengthen farmers' bargaining power, and promote transparency in agricultural markets.

3. **Financial access** to market actors, especially those financially excluded. These interventions facilitate the creation and integration of digital payment services, digital credit, and insurance services into existing market operations, thereby engaging stakeholders who are financially excluded from conventional financial services.

Two FCDO-funded comparator programmes are examples of how digital technologies are mainstreamed into MSD programmes to enhance the delivery of advisory and information services, improve market linkages and provide financial access services: eDIAL (Enhancing Digital and Innovation for Agri-Food Systems and Liveli-

hoods) and GAFSP (Global Agriculture and Food Security Programme). One of the approaches being explored by eDIAL and GAFSP is the use of digital technologies to improve the efficiency, integration, and inclusivity of agricultural market systems in developing countries (see Annex 1 for additional information).

In recent years, agricultural MSD programmes such as eDIAL and GAFSP are extending their approach beyond using digital technologies to bridge gaps in service provision to focus on the use of digital technologies to improve the business operations of small and medium enterprises (SMEs) to make them more competitive and profitable. This approach often entails providing TA to SMEs to integrate digital technologies such as enterprise resource planning (ERP) software, email platforms, and dashboards for tracking supply chains into day-to-day business operations. These interventions do not necessarily use the most cutting-edge technologies, like internet of things (IoT[6]) and artificial intelligence (AI), but focus on technologies with a proven track record for improving efficiencies and cost-reduction at

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[5] Bundled services - the combination of digital products and services together as a single unit or on a single platform on the mobile phone (Kakooza, 2014)

[6] IoT is an umbrella term for a global network that connects individually identified physical and digital things, objects, and devices with the ability to communicate, act, and be intelligent (Vongsingthong and Smanchat, 2014)

the SME level. For instance, shERPa[7] is an ERP solution funded by the GIZ Innovation Fund to support SMEs in developing countries to enhance their business operations and competitiveness through improving their efficiency in accounting, inventory management and connection to high-value supply chains (Schulz, 2021).

Despite the benefits of digital technologies in strengthening agricultural market systems, several issues remain a challenge to the effectiveness of trying to embed digital technologies in development programmes generally. These include poor in-country digital infrastructure, poor readiness of SMEs and other market actors for technology adoption, financial resource constraints, low-level of digital literacy, poor awareness of available technologies, poor monitoring and evaluation of the efficacy of digital solutions, and poor post-funding sustainability planning (Kapurubandara and Lawson, 2006; Nitturkar, 2021). To address these constraints, CASA (2020) recommended the adoption of a needs-led approach which takes into consideration the requirements and circumstances of value chain stakeholders (i.e., farmers, agribusinesses and end-consumers), the existing in-country digital infrastructure, and maturity of the digital space, when incorporating the use digital technologies into programme design to increase the likelihood of success.

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[7]   Digital Transformation at GIZ: https://reporting.giz.de/2020/corporate-sustainability/economic-capability/digital-transformation-at-giz/

CASA'S DIGITISATION WORK TO DATE

Digitisation was not explicitly built into the original design of the CASA Programme, i.e., there was no directive that digital solutions had to be used as a tool with partners. Mainstreaming of digital technologies was thus not initially considered as an element of the programme for achieving CASA's main objectives. The use of digital technologies was also not covered in the Theory of Change of the programme and consequently, there were no KPIs on digitisation in the logframe against which progress could be measured.

However, digitisation has been a needs-driven part of CASA's interventions from the early days of the programme, and the adoption of these technologies has been driven by requests from agribusinesses or CASA implementing partners. CASA Component A and CASA TAF have provided digitisation TA to a total of nine agribusiness and three mobile-based agri-VAS companies. Tables 2 and 3 group these two distinct categories depending on the main partner in the intervention.

Table 2: Agribusinesses included in the analysis of CASA's digitisation interventions

Name of Agribusiness	Country	Digitisation Start year	Status	Business-related Challenge	Digitisation / TA Provided	Category of agri-VAS
Component A						
Paicho Pasal	Nepal	November 20	Closed	Traceability issues; weak procurement and inventory management systems; poor decision-making process	Ne Supported with identifying, purchasing, and integrating a management logistics software into Paicho's business operations to facilitate procurement activities, inventory management and data-driven decision making pal	Supply-chain management
				Adapting to evolving consumer purchasing preferences	Funded the development of an e-commerce platform (mobile app) to facilitate the sales of produce during the COVID-19 lockdown	Market linkages
Sujal Diary	Nepal	August 22	Ongoing	Weak procurement and inventory management systems; poor decision-making process	Supported with identifying, purchasing, and integrating a supply-chain management software into Sujal's business operations to facilitate procurement activities, inventory management and data-driven decision making	Supply-chain management
				Need to efficiently provide advisory services to farmers	Funded the development of mobile application to improve the provision of advisory services to farmers	Advisory & information services
Himalayan Supervores (HS)	Nepal	November 21	Ongoing	Traceability issues; weak procurement and inventory management systems; poor decision-making process	Supported with identifying, purchasing, and integrating production management software and traceability software into HS business operations to facilitate procurement activities, inventory management and data-driven decision making	Supply-chain management
CASA TAF						
Arohan Foods	India	2022	In progress	Traceability issues; poor decision-making process	Funded and supported the integration of TapRoute (SaaS) platform into Arohan's business operations to facilitate traceability and data-driven decision making	Supply-chain management
Aliet Green	Indonesia	2023	In progress	Traceability issues; weak procurement and inventory management systems; poor decision-making process	Funded and supported the integration of a Google-based mobile application (AppSheet) and dashboard into Aliet Green's business operations to facilitate procurement activities, inventory management and data-driven decision making	Supply-chain management
Olivado	Kenya	2023	On-hold	Traceability issues; weak procurement and inventory management systems; poor decision-making process	Funded and supported the integration of a Google-based mobile application (AppSheet) and dashboard into Olivado's business operations to facilitate procurement activities, inventory management and data-driven decision making	Supply-chain management

Name of Agribusiness	Country	Digitisation Start year	Status	Business-related Challenge	Digitisation / TA Provided	Category of agri-VAS
Kentaste	Kenya	2022	In progress	Ineffective training and advisory provision to farmers	Funded the development of an in-house digital solution to provide digitally-accessed training videos to farmers	Advisory & information services
Sucafina	Tanzania	2022	In progress	Traceability issues; poor decision-making process	Funded and supported the integration of a management software (CropIn) to support data-driven decision making and meet compliance standards	Supply-chain management
Niche Cocoa Sourcing Limited	Ghana	2021	Closed	Inefficient payment systems	Developed digitisation process maps, identified financial services providers and cash-in/cash-out agents, and explored other financial products and services that can be bundled for farmers	Financial access

Table 3: Agri-VAS companies included in the analysis of CASA's digitisation interventions

Name of Agri-VAS	Country	Start year for TA	Status	Business-related Challenge	Digitisation / TA Provided	Category of agri-VAS
Component A						
Pathway Technologies	Nepal	2020	Closed	Inability to scale-out GeoKrishi to reach more smallholder farmers	Promoted Geokrishi to farmers and farmer organisations	Advisory & information services
CASA TAF						
DeHaat	India	2022	In progress	Expanding DeHaat's services to include new value offering; ccaling-out DeHaat's services to reach more beneficiaries	Funded and supported the integration of an in-house digital solution to promote improved inputs and practices to farmers	Advisory & information services
Farmerline	Ghana	2023	In progress	Improve operational efficiencies, scalability, potential impact, input sales and adoption, and brand loyalty	Funded and supported the integration of an in-house digital solution (Mergdata[8]) and facilitated the creation of a network of aggregators offering bundled services from input delivery, extension, and crop off-taking	Advisory & information services

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[8] Mergdata tracks and monitor integrated services and solutions to improve farmers' access to information, agricultural best practices, financial services, and markets.

The following section situates and contextualises these representative interventions amidst the previously-discussed initiatives funded by FCDO and GIZ, and against the conceptual underpinnings being referenced from the literature. To ground the learning in CASA's work, and the experiences of implementers and users, case examples from the Component A and CASA TAF interventions (drawn from Annexes 2 and 3) are provided, along with narratives from interviews and inputs from CASA staff.

The rest of this section on CASA's digitisation work to date follows the headings of:

TA on digitisation to agribusinesses: to digitise one or more aspects of their business operations. CASA interventions supporting agribusiness digitisation activities have taken four main forms:

- Digitising supply chain management processes
- Digitising market linkages
- Digitising financial access, and
- Digitising training, advisory and extension services to smallholder farmers.

TA to mobile-based agri-VAS: supporting companies to expand their operations and enhance their outreach to smallholder farmers and agribusiness entities.

TA on digitisation to agribusinesses

Table 2 above provides a summary of CASA's digitisation TA to agribusinesses. In addition, the full list of case studies illustrating how CASA has provided TA on digitisation to agribusinesses is available in Annex 2. The Annex provides information about the companies, their motivation for using digital technologies, the type of TA provided by CASA, and the immediate benefits of the intervention.

The information collected from Component A (Nepal) and CASA TAF about their respective processes of digitisation TA provision to agribusinesses indicates that both components follow a similar process with the steps below (also shown in Figure 2). This was validated in interviews and a follow-up "accuracy check" (i.e., queries back to informants to double-check points that had been added or changed to address comments from earlier readers).

- **Identifying challenges faced by agribusinesses** and selecting appropriate digital solutions or agri-VAS required to address those challenges.

- **Selection of the specific digital solutions,** based on the cost of the technology, the company's readiness for adopting digital technologies, how it fits within the agribusiness's existing operations and the ease of technology use by company staff.

- **Co-financing the intervention,** which requires that the agribusiness shares part of the total cost of technology implementation. In the case of CASA TAF interventions, CASA bears the larger share of the cost.

- **Supporting the introduction of digital solutions within the agribusiness operation,** including training the agribusiness staff on the use of the digital technology or agri-VAS implemented.

- **Supporting the agribusiness to harness the benefits of the digital solution,** including evaluating the usefulness of the digital solution and leveraging lessons learnt to improve the intervention by adopting an iterative approach.

Two points are worth mentioning here: 1) Should the digital solution pose new business-related challenges, appropriate fixes among the steps are explored as part of the intervention, and 2) some of the steps in the process may not be used in a particular partner business, as they may already have an idea of what system they want to use for a purpose and thus request CASA support to help them get it over the line, so, e.g., steps 1 and 2 may not then apply.

As reported by Component A (Nepal), "Our thinking was more towards how we can streamline individual business operations and operations, making them more efficient, and in doing so, we definitely followed these steps. There have been instances where steps 1 and 2 were not necessary as agribusinesses knew what systems they were looking for and CASA helped them de-risk that. That was the case with Himalayan Supervores."

Digitising supply chain management processes

Digitising supply chain management systems can drive efficiency in productivity, risk management, resource use, financial management, data-driven decision making, and traceability (Attaran, 2020). So far, CASA has supported the digitisation of three aspects of supply chain management, with the aim of reducing the reliance on inefficient manual systems (see Figure 3 and Annex 2). The data provided by Component A and CASA TAF revealed that in improving supply chain management processes, agribusinesses required digitisation support for procurement and inventory management, compliance and traceability, and data-driven decision making, with this last one being the most common challenge addressed with digitisation. Figure 3 draws from Table 2 to illustrate the number of cases where TA was provided to address challenges in supply chain management across the eight agribusinesses receiving TA support from CASA.

Figure 3: Aspects of supply chain management digitised by CASA TA (numbers of cases where TA was provided, some with the same partner)
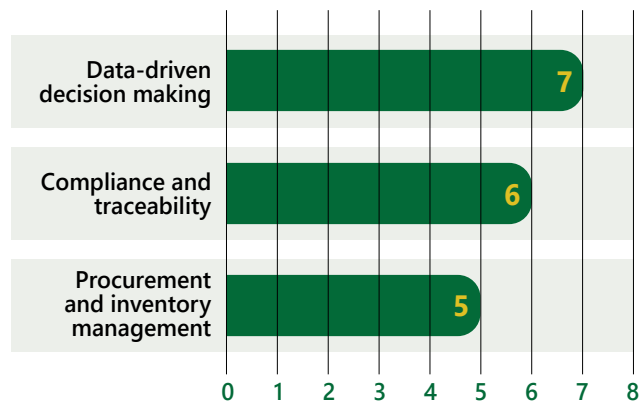
- **Data-driven decision making:** Agribusinesses require systems to aggregate, analyse and extract insights from data within their supply chains. These systems can manage farmers' data and maintain records of financial transactions, providing insights that agribusinesses can use to inform actions that optimise their supply chain, as well as mitigate market and climate-related risks. For instance, Arohan Foods (Component A / India) uses pest and disease heatmaps developed from data gathered through the TapRoute platforms to predict the likelihood of pest and disease outbreaks in the areas where their pig farmers are located in India. Paicho Pasal, Sujal Dairy and Himalayan Supervores (Component A / Nepal), and Aliet Green (CASA TAF / Indonesia) and Olivado (CASA TAF / Kenya) also received digitisation support to facilitate data aggregation and insights generation to make informed business decisions.

- **Compliance and traceability:** The weakness or absence of traceability systems presents a significant overhead cost to agribusinesses supported by CASA. This is due to the inability of the agribusiness to identify the exact source of poor-quality produce, making it difficult to ensure that produce aggregated from several smallholders complies with standards. Himalayan Supervores (Component A / Nepal), and Arohan Foods (India), Aliet Green (Indonesia) and Olivado (Kenya) [CASA TAF] received TA on digitisation from CASA to integrate traceability systems into their business operations.

- **Procurement and inventory management:** Agribusinesses in developing countries quite often rely on paper-based inventory management systems, which translates into high inefficiencies, costs and production losses. With support from CASA, Paicho

Pasal and Himalayan Supervores (Component A / Nepal), and Aliet Green (Indonesia) and Olivado (Kenya) [CASA TAF] identified the need for digitising procurement and inventory management systems to support business expansion.

Digitising market linkages

The digitisation of market linkages can improve the resilience of farmers, agribusinesses and end-consumers to external shocks that disrupt physical market operations (Bai et al., 2019). The COVID-19 pandemic created new challenges for agribusinesses worldwide, including those supported by CASA. Some of these challenges related to the disruption of face-to-face engagement between agribusinesses, farmers, and end-consumers, highlighting the need for alternative marketplaces for goods and services. Paicho Pasal (Component A / Nepal) received CASA's assistance in using an e-commerce platform to ensure continuous sales of vegetables during the pandemic.

Digitising financial access

Services aimed at digitising financial access typically connect smallholder farmers to formal financial services that are otherwise difficult to access through conventional banking systems (CASA, 2020). In agricultural markets, digitising financial access can facilitate transactions between farmers and agribusinesses through improving the efficiency and security of making payments as well as generating transaction histories that can act as financial records for farmers in accessing formal credit or insurance services (Hinson et al., 2019). CASA supported Niche Cocoa (CASA TAF / Ghana) in its financial inclusion initiative which sought to digitise payment systems for their smallholder cocoa farmers in Ghana.

Digitising training, advisory and extension services to smallholder farmers

Leveraging the widespread use of mobile devices in developing regions offers expanded opportunities to reach smallholder farmers with information and advisory services (Emeana et al., 2020). Before CASA support began, some agribusinesses in CASA's portfolio were already providing face-to-face training and advisory services to the smallholder farmers they sourced from. These agribusinesses identified the potential use of digital technologies as an avenue to promote efficiencies and cost savings in the provision of advice to their suppliers. With the TA support from CASA, Kentaste (CASA TAF / Kenya) [Annex 2] created low-cost video clips

for training farmers, while Sujal Dairy (Component A / Nepal) [Annex 2] used a mobile application to provide advisory services to farmers. As will be detailed more in a later section, the exorbitant cost of SMS advice to farmers in Malawi meant that the option was not pursued once the network providers confirmed they were not interested in subsidising the messages.

TA to mobile-based agri-VAS

Table 3 above provides a summary of CASA's TA to mobile-based agri-VAS companies, and is further described in Annex 3. The Annex provides information about the companies, their business challenges, the type of TA provided by CASA, and the immediate benefits of the intervention.

Mobile-based agri-VAS providers supported by CASA required TA to address business-related challenges limiting their capabilities for scaling up, achieving financial sustainability, and maximising their impact potential. CASA currently provides TA to Farmerline (CASA TAF / Ghana), Dehaat (CASA TAF / India), and Pathway Technologies (Component A / Nepal) to improve their service offering, as well as to increase their customer base (smallholders, aggregators, and agribusinesses). Details about each intervention are covered in Annex 3.

As with the above Component A and CASA TAF processes of digitisation TA provision to agribusinesses, the information collected from Component A (Nepal) and CASA TAF about their respective approaches indicate that both components follow a similar process – also validated in interviews and a follow-up "accuracy check" – in their TA support to mobile-based agri-VAS, with these steps (also shown in Figure 4):

- **Needs assessment and consultations with agri-VAS** company to identify the business-related challenges, define the overarching business objectives, as well as to evaluate the company's existing expertise, technical infrastructure, and resources.
- **Recommending the appropriate approach and business processes** based on the needs assessment and outlining the approach required to support the delivery of digital solutions.
- **Training and capacity building** of company staff to equip them with the technical skills required to adopt and maintain the technical solution recommended.
- **Pilot-testing** through small-scale deployment of the technical solution within a given geographic area using selected users. This also facilitates the collection of feedback to inform improvements to the solution.

- **Post-pilot scale-up plan** in collaboration between the agri-VAS and CASA, with the aim of scaling the solution and continuously working towards leveraging the benefits.

- **Monitoring and evaluation:** CASA and the agri-VAS company monitor and evaluate the progress of the solution against set KPIs at activity level and if challenges arise with the use of the solution, or new business challenges arise, the cycle begins with a needs assessment and technology assessment (see Figure 4).


Figure 4:
CASA process for providing TA to agri-VAS companies

Here it should be noted that CASA TAF is more likely to introduce the idea of digitisation TA support to agri-VAS than Component A, whose support is more in reaction to the needs of agribusiness partners.

As a case in point, Component A (Nepal) reported that:

Our support to Pathway Technology Pvt Ltd (GeoKrishi app) [an agri-VAS] and Himalayan Supervores [the partner agribusiness] was completely different. GeoKrishi was a digital company itself to begin with. Hence if you look at it from a market systems perspective, it was a company that had a product that could solve farmer's technical problems. CASA support towards GeoKrishi was to test their technology (app) with the five cooperatives, assess the customer response and based on the response, fine tune the technology offer. With the support from CASA, Pathway was able to recruit a team of experts from various departments such as development, operation, communication, and support system to execute the overall programme. Now, the team has been fully equipped in terms of the content, tools and approaches, which was vital for scaling up GeoKrishi beyond the project duration. Before CASA, Pathway had an individual outlook to promote technology adoption where their implementation was limited to individuals and a few farming communities. Later through CASA, a business model was curated by forging a partnership with larger farmers cooperatives and local service providers. This model and approach supported cooperatives to evaluate their situation in various arenas like mapping resources and design of a digital agriculture framework to increase access to information and markets; monitor and manage farms; and connect value chain actors through a common digital platform. The interconnected and complementary approach of this partnership provided new opportunities and values among the targeted users: farmers.
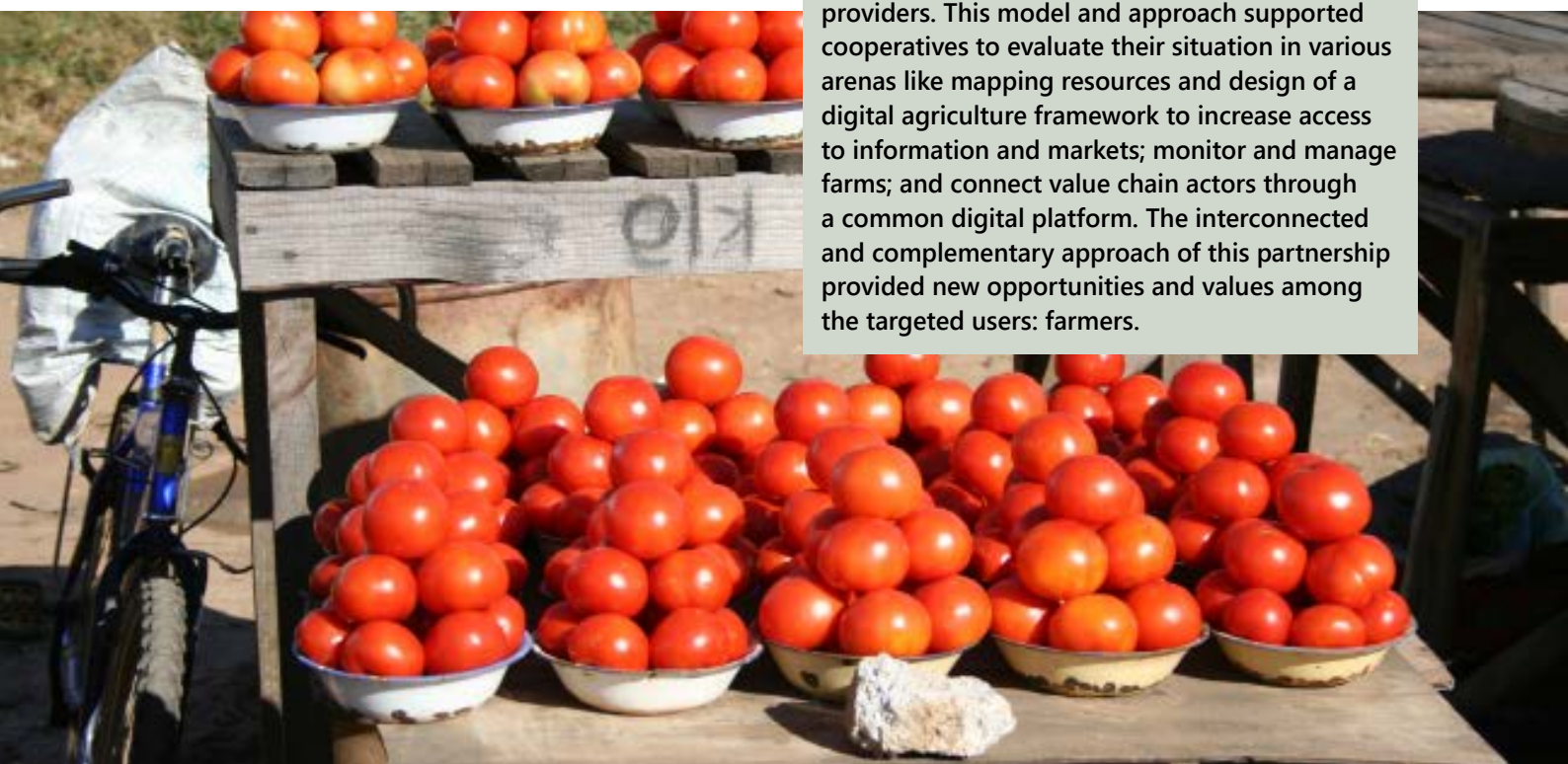
CHALLENGES AND MISSED OPPORTUNITIES

Based on the information provided by Component A and CASA TAF, three challenges that can be stated for the provision of digitisation TA to agribusinesses are:

- Costs of digital technologies,
- Level of development of in-country digital infrastructure, and
- Readiness of agribusinesses to adopt digital technologies.

Cost of digital technologies

The acquisition and integration of digital technologies in business activities requires a significant financial investment, both in the initial phases as well as for continued access of the service, which is often a challenge for resource-constrained agribusinesses (Bai et al., 2021). Costs usually include expenditures on hardware, software, staff training and monthly payments for accessing a service. These costs pose a greater challenge to agribusinesses supported by Component A, as they are in the early stages of financing. Agribusinesses supported by CASA TAF also struggle to absorb these costs, even though they are bigger and have greater access to capital. During the COVID-19 lockdown period, the high costs of proposed digital solutions prevented some of CASA's agribusinesses from accessing them.

The majority of CASA's 14 digitisation support activities (right-hand columns of Tables 2 and 3) with the 12 partner businesses reviewed here were for advisory and information services (5) and supply-chain management (7), with one each for market linkages and financial access, and none for macro-agricultural intelligence or super platforms (value chain integrated services). The preponderance of the first two categories would imply

both genuine business-driven needs and affordability within the budget parameters of the business and the partnership with CASA.

Level of development of in-country digital infrastructure

Digital infrastructure and agri-VAS availability vary across countries. The level of technological advancement is usually determined by the policy enabling environment, physical infrastructure, and size of the market in the country. For instance, in sub-Saharan Africa, Kenya and Ghana have more developed digital infrastructure and technology ecosystems than other countries like Malawi. In South Asia, the digital infrastructure is more mature than in sub-Saharan Africa, which significantly influences agribusinesses' ability to integrate digital solutions into their operations. This is evident with the cases presented here of digital interventions implemented by the CASA Programme (Tables 2 and 3).

With regards to these first two challenges, Component A (Malawi) identified some missed opportunities for using digital technologies with their agribusinesses, due to the high cost of agri-VAS offering[9] in the country, and the low level of development of in-country digital infrastructure. These missed opportunities are:

- Agronomic advisory services for climate change information and advice, including early warning systems for climate-related shocks.
- Farmer mapping tools that can be used to organise producers and increase the efficiency of produce aggregation.
- Online training and consultation between SMEs and specialists; this was particularly relevant during the COVID-19 lockdown.
- Digital accounting systems for real-time information exchange and online collaboration.
- Mobile money platforms that facilitate loan repayments for small and medium-sized enterprises.

In Malawi, a couple of partners were considered for specific interventions on this list, e.g., the online training during COVID-19, or messaging systems through a company called Viamo. When the country team reached

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[9] Viamo recommended a 5 to 8 module trainings lasting 5 to 7 minutes each; set-up costs: US$ 5,000; content creation: US$ 5,000; translation and recording: US$750; Airtime: US$0.10 per minute. This was also not clear/deterministic because they asked for the exact number of smallholders Component A intended to reach as that would determine the amount of airtime which would influence the cost.

out to Viamo, who were considered the most capable service provider, the pricing structure and resulting cost was quite unaffordable for the scale of projects run. Discussions at programme level concluded that there was not the level of budget required to pursue these services, for reasons of both immediate cost and sustainability by the SME after CASA support. In addition, opting for such a solution was going to raise other constraints for some farmers, e.g., mobile phones to anchor seamless and sustainable delivery of the service.

On whether mobile platforms are feasible, Component A (Malawi) reports that none of the Village Savings and Lending Association (VSLA) groups organised around their partners use mobile money solutions of any kind. One of the projects they are currently designing seeks to work with VSLA groups which are far more developed. However, a check with the partner establishes that even these groups have not yet adopted mobile money solutions or any form of digitisation. The reason is the same: high transaction cost for both mobile money platforms and banking solutions.

Readiness of agribusinesses to adopt digital technologies

The implementation of digital interventions at the agribusiness level has been driven by the request for this kind of support directly from the agribusinesses and their readiness to adopt digital technologies. Not all of the reviewed agribusinesses had the same level of maturity, and this influenced both need and readiness. In some cases, agribusinesses were not at the stage of really understanding the key bottlenecks they face around their core business activities.

For CASA TAF partners, in most cases, identification of core business issues is part of the TA but in select instances, core business issues relate to the need for fundraising or access to working capital that also affect digitisation efforts, e.g., related to digitisation of payments. Across both Component A and CASA TAF, other partners were not aware of the range of existing agri-VAS or digital tools available in their geography and for their agribusiness, or how connecting to those could help them improve efficiencies and reduce costs of running their business. This highlights the potential need to raise the awareness of agribusinesses supported by CASA on how similar agribusinesses have used digital technologies.

In the case of TA support to mobile-based agri-VAS,

there are two additional challenges faced by CASA implementing partners and agri-VAS providers, which have been covered by the literature in the digital agriculture space:

- Achieving financial sustainability in the service provision (Jadhav et al., 2011; Emeana et al., 2020), and
- Being able to evaluate the impact of accessing the services both at the agribusiness and farmer levels (CASA, 2020).

Achieving financial sustainability in the service provision

Over the last two decades hundreds of agri-VAS have emerged in Sub-Saharan Africa and South Asia, but the majority of agri-VAS never reach financial sustainability or scale and are discontinued after a few years. This situation is starting to change, and some agri-VAS are achieving sustainability and scale. The main success factors identified by CASA research for achieving financial sustainability are (CASA, 2020):

- Designing and tailoring the service around a clear demand and willingness to pay
- Having an adaptive pricing model aligned with a bespoke service offering
- Reducing the cost structure of the service wherever possible
- Including financial services and mobile payments as a revenue stream, and
- Redistributing the cost of running the service across different for-profit business lines.

Evaluating the impact of the services at the agribusiness and farmer levels

A successful agri-VAS is not necessarily the same as an impactful service from a development point of view. For the purposes of monitoring and evaluation, it is therefore critical to differentiate between number of users registered in a service (e.g., number of app downloads, or phone numbers listed), the number of regular active users of the service, and the actual impact that the service is having on a proportion of the active users. There are several studies exploring the effectiveness of text messaging, but the evidence of impact on practice adoption is mixed (e.g., Schulz and Berner, 2023; Fabregas et al., 2019). However, it is uncommon to find rigorous evaluations of the impact of an agri-VAS delivering broader agribusiness related services – or of the financial viability of services. In the case of agri-VAS

supported by CASA, it is a missed opportunity that the programme has focused on the provision of TA without looking into the evaluation of the impact and cost-effectiveness, as that would not only contribute to shedding light on the impact of the programme, but also contribute to the wider evidence base in the field. However, CASA TAF does report that they are performing cost-benefit analysis when the budget allows, such as the current case with DeHaat (see Annex 3).

As indicated by the CASA Monitoring Evaluation and Learning (MEL) team, at the programme MEL level, though not built into the current measurement arrangements, the impact of the digital innovation could be evaluated in terms of efficiency, increased access to services and the value of transformation that comes from the services accessed. For example, for digital solutions that focus on increased access to extension advisory and market services, a before-and-after comparison or retrospective comparison (if no baseline) could be done to establish what value of sales is through or due to the digital platform, e.g., price gains or cost savings. The evaluation should be able to filter access costs as most digital providers monetise their services such that their access costs are distributed among users or alternatively automatically charged at the service access point.

KEY LESSONS LEARNED AND SUCCESS FACTORS IN PROVIDING TA ON DIGITISATION TO AGRIBUSINESSES

This section reflects the lessons learned from CASA Component A and CASA TAF, including feedback from Country Intervention Managers and Market Managers who have been directly engaging in these interventions, with examples drawn from the fuller descriptions in Annex 3 and interviews with CASA staff.

Digitisation interventions should be needs driven

Digitisation interventions should begin with a needs assessment to determine the main challenges faced by the agribusiness and determine if a digital or non-digital solution is best placed to address the challenges. Although it was not the goal of CASA to introduce digital technologies to agribusinesses, identifying challenges faced by agribusinesses motivated CASA to recommend the use of digital solutions. In the case of Component A (Nepal), with partners Paicho Pasal and Himalayan Supervores, all software was designed to create value for the agribusiness and their supplying farmers. Prior to designing digital activities, the operational and growth gaps of the company were identified as needs. These gaps were the basis for selecting and developing digital services, technological interfaces, systems and software that the company and their respective supply/distribution channels can use to increase their performance, without it being too complex for them to absorb into their day-to-day operations."

Digitisation activities should leverage available and customisable technology solutions rather than developing bespoke digital solutions

One of the primary causes for poor sustainability of digitisation interventions in MSD programmes is the substantial financial investment required for developing, implementing, and maintaining the use of digital technologies (Schulz, 2021). Sustainability challenges can be resolved using Software-as-a-Service (SaaS) where applicable, as done by CASA TAF for Aliet Green, Arohan Foods and Olivado. SaaS are products that can be configured to the user needs and scaled up cost-effectively. The scalability of these SaaS products is a vital functionality to cater to the emerging needs of agribusinesses, as they grow or diversify into new ventures over time. Utilising SaaS products also facilitates faster implementation, which suits the dynamic nature of the agribusiness ecosystem, where the prompt implementation of digital solutions can substantially influence profitability and competitiveness. Furthermore, most of these technologies are designed to be interoperable, making integrating into pre-existing agribusiness systems and procedures more accessible.

Despite the opportunities that SaaS can present, options in the AgTech space are limited. As reported by CASA TAF, "[e]xisting AgTech solutions do not have a technology architecture that is configurable or scalable. Platforms are notoriously resource intensive to purchase, customise, implement, and maintain because they are not "true" Software-as-a-Service (SaaS) products. Instead, AgTech solution providers usually deploy customised, one-off versions of their products for each project, passing off the costs and risks of these customisations to the agribusinesses. Most of the time, these costs cannot be carried forward and the platforms cannot be maintained sustainably, resulting in technology systems only being used during short pilots. Agribusinesses also commonly face implementations which fulfil only a partial list of promised requirements in practice, forcing agribusinesses to invest in other technology solutions to supplement platforms at an even greater cost and/or abandon newly implemented platforms completely."

Cases where CASA TAF partners found gaps in existing technology platforms they were using, and needed more flexible tools to help them adapt digitisation efforts based on field realities, include:

- With Olivado, where CASA TAF contracted a service provider to leverage tools from the Google Suite – AppSheet for the mobile application and Google Sheets for the back-end dashboards. This platform enabled real-time monitoring of procurement data and streamlined payment reconciliation, reducing the lengthy payment processes for farmers.
- With Kentaste, where CASA TAF facilitated the design and incorporation of digital tools and technology that could complement their existing farmer training activities and potentially contribute to farmers' increased adoption of agricultural practices.

Co-financing the implementation of digital solutions could support the long-term sustainability of digitisation interventions post-donor funding

As previously stated, the high cost of digital technologies constrains most agribusinesses in developing countries from integrating digital solutions into their operations. The provision of financial support by donors like FCDO in a pilot or start-up phase can alleviate the initial financial burden on local businesses and increase the viability of these digital interventions. Donor support also helps resource-constrained agribusinesses mitigate the risk and uncertainties associated with using new technologies, by providing a cushion for potential losses in case digitisation interventions do not work. As observed by Component A (Nepal), "It is important that businesses are aware about their capacity to transition towards digital platform and technology and are also willing to invest. Many businesses seem to be willing to adopt new technologies but do not really seem have the capacity to implement it. CASA has been careful in selecting those SMEs that have willingness and capacity to implement digital technologies."

Co-financing could ensure the sustainability of these digitisation interventions, as it gives the agribusiness a sense of ownership of these interventions and instils a commitment to the overall success of digital solutions. Findings in this report highlight that CASA's digitisation interventions have followed a co-financing model, with the agribusinesses bearing some of the cost of the intervention and the programme covering the rest. Examples from Component A (Nepal) are Paicho Pasal with 60% and 40% respectively, Sujal Dairy at 65% and 35%, and the case of Himalayan Supervores (HS), where CASA financed software development and HS covered costs for hardware and tracking codes.

The use of digital solutions for business activities should be discontinued when they no longer serve business objectives

The business development requirements of agribusinesses are constantly evolving to meet changing consumer preferences and market demands. Technologies that are obsolete or unused have the potential to hinder business operations. Agribusinesses can therefore decrease their overhead costs and increase their responsiveness to evolving opportunities by eliminating digital solutions which no longer meet identified business needs, or by modifying them to avoid redundancy.

The experience of Component A (Nepal) shows that – when business objectives change – digital solutions need to be re-tooled: "Launching e-commerce platforms during COVID-19 supported companies like Paicho Pasal to maintain connections with retailers, wholesalers, and individual customers. The platform ensured that the company took up the opportunity for online selling and in turn did not suffer from decreased sales due to pandemic lockdowns. However, the usage of the application from local individual customers decreased after the pandemic as customers who had physical access to the company products/produce preferred to directly come, check the quality and buy it rather than to order online. To ensure that the

application was not completely obsolete, Paicho had it re-calibrated and made more user-friendly towards active users such as wholesalers and retailers."

KEY LESSONS LEARNED AND SUCCESS FACTORS IN PROVIDING TA TO AGRI-VAS COMPANIES

Identifying and utilising "digital champions" can support the uptake of mobile-based agri-VAS

According to Kabbiri et al. (2018), historically, farmers in developing countries have been disproportionately disadvantaged in the uptake of digital innovations due to their low level of digital literacy, coupled with the high cost of mobile devices, internet data and poor internet infrastructure in rural areas. However, farmer-to-farmer knowledge sharing (Kipot and Franzel, 2019) in CASA has proven to be effective in building the capacity of farmers on the use of digital technologies, as well as overcoming risk aversion and trust issues. Interviews revealed that using digitally literate farmers (digital champions) for knowledge sharing facilitated the adoption and use of the GeoKrishi mobile application in Nepal, as follows.

The idea was to hire local youths in different working districts who would eventually provide training and advice to farmers/cooperatives and their extension workers on how to use the GeoKrishi App. For this, Pathway trained 20 local youths (10 from each province) with CTEVT certification and good exposure to digital technologies. Upon joining the training, the youth got access to a mobile app, real-time and contextualised advisory information and a local help desk that supported cooperatives and farmers to set up community-based digital agriculture service centres.

Further, the trained youth acted as local digital champions and mobilisers who became GeoKrishi brand ambassadors and scaled up project activities with other farmers' cooperatives. These digital champions were local resource persons who provided further training to farmers' cooperatives and their local service provider (JTAs). Training included specialised modules covering both advanced digital farm management and business literacy. This model helped scale up Geokrishi's farm management tool and as such these are now being used by more than 120,000 farmers across Nepal.

Pilot testing technical solutions should be agile and iterative, allowing for modification of features and functionalities based on feedback from end-users of the agri-VAS

Piloting technical solutions should be performed in collaboration with the users of the service, adopting an iterative approach that accommodates their inputs. This feedback is crucial for fine-tuning and modifying the digital solution to better align with the needs and preferences of end-users. Examples of such pilot initiatives are CASA TAF's work with DeHaat in India and Farmerline in Ghana.

TA should adopt a multi-stakeholder and multi-disciplinary approach where possible

Finally, and importantly, to demonstrate CASA's commitment to the crosscutting theme of Gender Equality and Social Inclusion (GESI), digitisation activities should not further exacerbate existing gender, socio-economic and digital divides, especially where development and empowerment are the intervention goals. Adopting a multi-stakeholder, multi-disciplinary and gender-sensitive approach to understand and address the needs and constraints of different sectors of the community will ensure all stakeholders' interests are considered and the intervention does not create new challenges for beneficiaries.

CONCLUSIONS AND RECOMMENDATIONS

The use of digital technologies was not explicitly built into the original design of the CASA Programme, i.e., there was no directive that digitisation had to be used as a tool with partners. However, the needs-based requests for it from agribusinesses and implementing partners (in lieu of or alongside other partnership activities) has led both CASA Component A and CASA TAF to become active in the field, through an adaptive and demand-led approach to digitisation support, if a partner seemed a good candidate to benefit from it.

Through similar, flexible processes for digitisation TA provision, both CASA components have together supported nine agribusinesses and three mobile-based agri-VAS companies in six countries. In most cases, agribusinesses supported by the programme have requested the adoption of existing digital technologies to perform core business activities more efficiently and cost-effectively. In other cases, CASA has worked with the agribusinesses to identify core business activities where an in-house solution could be developed. Additionally, the CASA Programme has directly supported agri-VAS companies as a means for achieving the programme's key performance indicators, particularly on farmer outreach.

Given the inevitability of the increasing availability and use of digital technologies in almost every aspect of human life and in business environments – and in recognition that CASA partners and associated smallholder farmers are already moving in this direction, and expressing needs for digital solutions – this paper has provided a foundation for the further and deeper consideration of digitisation as a necessary element in project concepts, plans and agreements. Having said this, CASA and FCDO will need to more carefully understand challenges to this direction having to do with cost, variability

in digital infrastructure, business readiness and adaptability, financial sustainability, and a lack of cost-benefit analyses and impact evaluations.

However, CASA has begun learning lessons about what works successfully in the relatively small – though representative – number of cases presented here. In its partnerships with agribusinesses, these lessons speak to interventions being needs-driven, as identified by and in collaboration with partners; leveraging and adapting existing digital solutions, and where applicable, bespoke ones; requiring co-financing so as to foster sustainability of the solutions; and recognising when solutions either need re-tooling, or are obsolete.

In their support to agri-VAS, Component A and CASA TAF have learned that success rests on tapping into digitally-literate communities of people who can be champions, working as easily alongside business people as with farmers; starting small with pilot initiatives; and keeping true to stated aspirations embodied in crosscutting themes that seek to close divides among people such as climate change and the environment, gender equity and social inclusion, and food and nutrition security, while narrowing digital divides among us as well.

A return to the case studies of the two FCDO-funded comparator programmes and the 12 reviewed CASA partners (Annexes 1, 2 and 3) illustrates how digital interventions contribute to outcomes in the aspirational crosscutting themes. Smallholder farmers can access advisory services and maps about pests, diseases and weather, enabling them to adapt in climate-smart ways, and become aware of environmental standards. With digitisation, agribusinesses can reduce paper use, streamline their work processes, and become more attractive to investors. In contexts where women comprise

a significant proportion of smallholder farmers in a value chain, they are supported with advisory, extension and training services; and in the case of a women-owned business (Aliet Green), to improve its operational efficiency and track their 2,000 women farmers' activities, including distributing and paying for coconut seedlings. Smallholder farmer families are likewise supported towards greater food and nutrition security when digitisation leads to higher productivity, reduction of crop loss and food waste, continued sales during crises such as pandemics, timely payments and documented transaction histories. Although it would need to be explored through further research, a claim could be made that digitisation can potentially lead to greater overall resilience of agri-SMEs and their smallholder farmer partners.

There are four sets of recommendations emerging from this review, which are relevant for the final years of CASA implementation and for FCDO's future programming in market systems development, with regards to programme management, TA to agribusinesses, TA to agri-VAS, and FCDO programming, as below.

Programme management recommendations for CASA moving forward

- The programme could benefit from ensuring that the use of digital technologies can **contribute to existing KPIs** by **including clear KPIs around the use of digital technologies in its project interventions where relevant,** as for the moment the evidence presented is anecdotal and based on self-reporting. These **KPIs should mainly focus on measuring the impact that these digitisation interventions are having,** depending on the approach used:
  - TA on digitisation to agribusinesses. Inclusion of KPIs on the extent to which the use of digital technologies is helping the CASA-supported agribusiness to reduce operating costs and improve efficiencies, as well how the use of these technologies is helping the agribusiness adapt to climate change. For instance, percentage cost reduction in agribusiness operating cost.
  - TA to existing mobile-based agri-VAS. Inclusion of KPIs to evaluate the extent to which the interventions are helping the agri-VAS

to achieve financial sustainability, as well as impact at the farmer level (beyond number of app downloads and registered users).

- The inclusion of these project-level KPIs should be accompanied by a **dedicated MEL effort to assess these impact dimensions,** to be included in the endline project-level close-out report, with a system to ensure that such elements are picked up in quarterly/annual reports.

- In countries where both types of interventions are taking place (TA on digitisation to agribusinesses and TA to agri-VAS providers), **the programme could consider connecting both types of interventions** (e.g., as Paicho Pasal and Geokrishi were connected in Nepal). This would help the programme to better evaluate the impact it is having both at the agribusiness and farmer levels, and to tailor the TA provided to the agri-VAS based on feedback from the agribusiness.

Providing TA on digitisation to agribusinesses

Intervention planning:

- **The intervention planning process** with partners should start with an assessment of the business needs where digital technologies can play a role, the technological readiness of agribusinesses to adopt these solutions, their in-house and financial capacity to use these technologies and cover the investment costs of accessing them, as well as the availability and selection of service providers.

Costs:

- **Understand the return on investment for CASA** to support the use of digital technologies compared to traditional interventions.
- **Implement cost-benefit analyses for each agribusiness** that has used digital technologies to date, and for any agribusiness seeking to use such a technology as part of any initial support, to assess the need for continued use of the technology.
- **Plan for covering the costs** for after the project comes to an end.

TA and knowledge sharing:

- **Develop additional training packages for agribusinesses** to enable them to fully capitalise on

the use of these technologies as well as to ensure that farmers also share some of the benefits.

- **Based on the cost-benefit analysis recommended above, raise awareness** across the portfolio of agribusinesses supported by CASA on the potential uses of digital technologies.

- **Training for agribusinesses on best practices for gathering, storing, and sharing user data** emerging from the use of digital technologies.

- **Promotion of cross-learning among agribusinesses** that have already used digital technologies, including sharing lessons within and between Components A and CASA TAF.

Providing TA to agri-VAS

Intervention planning:

- Based on the experiences reported and challenges identified in this study, in its interventions with agri-VAS partners, CASA should **concentrate on promoting financial sustainability of the agri-VAS and increasing and evaluating the impact of the service provision** on SMEs and smallholders.

Financial sustainability at scale:

- From existing research in the field (Emeana et al., 2020), it is known that reliance on donor funding poses a challenge to financial sustainability. It is therefore critical to pay particular attention to the **development of a sustainable revenue structure,** for instance, designed around business to business (B2B) revenue, making the services free or partially subsidised to farmers (CASA, 2020).

- **The design of sub-service offerings from the agri-VAS provider is critical to ensuring the impact and financial sustainability of a service.** The design should be based on: a) identifying clear demands for services from target customers (e.g., agribusinesses); b) bundling several services to increase the willingness to pay and the potential impact of the service at both farmer and agribusiness levels; and c) including financial services (e.g., mobile payments), which increase

the number of revenue streams and which both farmers and agribusinesses are more willing to pay for than other sub-services (as these others tend to demand payment by commission) (CASA, 2020).

TA and knowledge sharing:

- **Promotion of cross-learning among agri-VAS's** that have already been supported by Component A and CASA TAF across different geographies (Ghana, India, and Nepal) would be beneficial for the implementation of the programme and facilitate the gathering of lessons learned.

Future FCDO programming

- **The use of digital technologies in MSD programmes should be considered in the development of FCDO Theories of Change,** particularly as a way for improving efficiencies, reducing operating costs and as a coping mechanism to react to market shocks.

- **Programme design should incorporate digitisation KPIs** in the logframes from the initial stages of development of the programme.

- When developing an MSD programme that intends to use digital technologies, an **analysis of digitisation programmes in similar contexts should inform the design** stages.

- To ensure sustainability and scalability of MSD programmes using digital technologies, **FCDO should ensure that there is budget support for evaluations of the impact of digital interventions.** This would help increase the evidence base and support the pipeline of investable agribusinesses.

- In designing future MSD programmes, **FCDO could focus on programmes which enable both agribusiness and agri-VAS companies** to use data gathered through digital technologies to inform decision making and to enhance business performance. These programmes could be implemented in collaboration with agri-VAS providers to deliver training and capacity building.

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ANNEX 1
CASE STUDIES ON THE USE OF DIGITAL TECHNOLOGIES IN AGRICULTURAL MSD PROGRAMMES

Enhancing Digital and Innovation for Agri-Food Systems and Livelihoods (eDIAL) Programme

The eDIAL programme responds to the pressing global challenges of feeding a growing population, adapting agriculture to climate change, and addressing the vulnerabilities of smallholder farmers by leveraging digital technologies.

Programme Components[10]:

- GSMA AgriTech: In its final year, this component partnered with Mobile Network Operators, agribusinesses, and mobile money providers to test and scale financially sustainable business models for digitising the agricultural value chain. Notably, GSMA AgriTech yielded valuable evidence on the efficacy of digital interventions with smallholder farmers.

- Ethiopian Digital Agricultural Advisory Services (EDAAS): The component delivers digital agriculture advisory services (with support from the Bill & Melinda Gates Foundation) in Ethiopia through video-based and interactive voice recording channels. It also involves the development of FarmStack, an open-source data transfer platform, ensuring secure data transfer across public and private actors in the food and agriculture sector.

- Agbase: Formerly known as the Digital Agriculture Hub, aims to track and operationalise data on investment and innovation in digital agriculture, offering insights to stimulate the market and address risk misperceptions.

Outcomes and Impacts:

- Increased Adoption: eDIAL targets the adoption of information, financial, and market access technologies by smallholder farmers, contributing to FCDO Science and Technology KPI to benefit 500 million people in Low and Middle-Income Countries (LMICs) by 2025.

- Increased Investment: The programme seeks to attract increased investment into innovative solutions for sustainable agriculture. This includes enhancing resilience through smallholder farmer investment enabled by improved access to finance and mobilising finance for impactful digital platforms.

- Improved Data and Evidence: eDIAL strives to enhance data and evidence for decision-making by the private sector, donors, and policymakers. This includes climate and weather advisory services for farmers, contributing to positioning the UK as a global science power.

Lessons Learned:

- Transitioning to a new business case should prioritise adaptability and incorporate lessons learned from the programme.

- Programme components should publish a plan for long-term sustainability.

- Apply lessons from EDAAS as the programme expands to new geographies.

- Maintain close monitoring of programme component from inception phase to enable proactive addressing of emerging issues.

eDIAL's adaptive approach and performance showcase its potential for significant impact across geographies to implement MSD, underscoring the ongoing importance of investing in digital technology for agriculture, especially in the face of global challenges and uncertainties.

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10   eDIAL Annual review (D0003357) 300644 (Published - October 2023)

Global Agriculture and Food Security Programme (GAFSP)[11]

The GAFSP has implemented innovative digital initiatives to improve agricultural productivity and market access for farmers in developing countries, ultimately bolstering the economic resilience of vulnerable countries globally.

Programme Components[12]:

- e-GRANARY Mobile Platform: A mobile-centric solution facilitating demand-supply matching for agricultural produce and inputs. This platform reduces costs, mitigates risks, and provides targeted agronomic support throughout the growing season. It empowers service providers to invest in and serve smallholder farmers, fostering increased productivity, incomes, and livelihoods.

- Twiga Foods Web and Mobile Application: A comprehensive web and mobile application managing the agricultural value chain. Twiga Foods aims to connect its farmers to global markets, ensuring adherence to ISO standards. The platform leverages existing wireless data networks, allowing stakeholders to capture transactional information at the source, enhancing transparency and efficiency in the agricultural value chain.

- Monitoring of Hazelnut Farmers in Bhutan: Technological support for monitoring 15,000 outgrowing hazelnut farmers scattered across challenging mountainous terrain. The technology addresses challenges faced by the Project Coordination Unit, including working with multiple data sources, replacing excessive paperwork, and geo-tracking remote activities at the community level. It contributes to quick and timely progress reports by extracting meaningful information.

- E-Platform Supply Chain Network in Liberia: Establishment of an e-platform supply chain network serving as one-stop farmer shops. This network streamlines services, including farmer registration, e-extension services, input distributions, and off-taking arrangements across Liberia's entire agriculture sector.

Outcomes and Impacts:

- Mobilised over 6,000 farmers and established key partnerships with buyers and financiers, targeting the adoption of digital technologies by smallholder farmers, contributing to improved productivity, income, and livelihoods.

- Scaling up mobilisation efforts, focusing on securing harvests, increasing farmer access to input credit, and expanding output markets in upcoming crop seasons.

- Generated comprehensive farmer data and partnership ecosystem mapping and provided support to the Ugandan government to partner in digital literacy.

GAFSP's approach with digital platforms highlights the potential for significant impacts on agricultural MSD.

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[11] Support to the Global Agriculture and Food Security Programme (GAFSP)
[12] Woodward, 2019

ANNEX 2
CASE STUDIES ON CASA'S TA ON DIGITISATION TO AGRIBUSINESSES

COMPONENT A

Paicho Pasal

Established in 2013, Paicho Pasal aggregates and sells agricultural products sourced from smallholder farmers in Nepal.

Category of agri-VAS: Supply-chain management; Market linkages.

Motivation for digitisation (Push or Pull)[13]: Pull demand from the agribusiness.

Paicho Pasal had two business challenges:

- Paicho sought to improve its inventory management system to reduce operational expenses and improve efficiency. This entailed incorporating functionalities to collect and analyse supply chain data and track production and sales.
- During the COVID-19 lockdown, Paicho needed assistance integrating a digital platform into its sales operations.

TA provided: CASA identified Enterprise Resource Planning (ERP) software that aligned with Paicho Pasal's specific needs and facilitated the procurement process by obtaining quotations from various software service providers. Using COVID-19 Response Grant support provided to Paicho, CASA contracted Divalo Technologies to develop an e-commerce platform (from scratch) that enabled Paicho to maintain sales during the pandemic while also continuing to buy from farmers. Also, to cut costs, streamline operations and increase efficiency, CASA supported Paicho to integrate software in various sections of its operations. This included inventory management software,

tracking production cycle software, sales software and financial software. CASA bore 60% of the digitisation implementation costs, while Paicho bore 40%. Before this, Paicho did not have an e-commerce platform.

Immediate benefits: Digitising the inventory management system and financial system has reduced Paicho's paper consumption by 60%, from an annual cost of £3,775 to £1,500. In terms of efficiency, another immediate benefit for them has been more accuracy in calculation and the ease of getting data instantly.

Sujal Diary

Sujal Dairy is a milk processing company aggregating milk from over 20,000 smallholder dairy farmers in Nepal.

Category of agri-VAS: Supply-chain management; Advisory and information services.

Motivation for digitisation (Push or Pull): Pull demand from the agribusiness.

Sujal sought to develop a comprehensive data capture system for its dairy supply chain to facilitate efficient operations and supply chain management. The objective was to enable Sujal to monitor its daily milk procurement and maintain a digital database of farmers. Sujal intends to use data aggregated through this digital system to extend advisory services and training to farmers they source produce from.

TA provided: CASA linked Sujal with Salesport's mobile application and software for supply chain management and providing advisory services to smallholder farmers. Salesport is based in India and offers dairy-re-

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[13] Push: If the motivation to digitise is external to the agribusiness (i.e., from donors, investors and/or policy makers). Pull: If the motivation to digitise is internal to the agribusiness (i.e., directly or as recommended by CASA to solve challenges jointly identified by the agribusiness and CASA).

lated software to other Indian dairy companies but has tailored its mobile application and software to suit Sujal's specific needs. CASA covered 65% of the total cost of the software and mobile application.

Immediate benefits: Sujal has recently compiled a database of 700 farmers and plans to pilot its software and mobile application with 2,500 farmers.

Himalayan Supervores

Himalayan Supervores (HS) is a vegetable aggregation company in Nepal.

Category of agri-VAS: Supply-chain management.

Motivation for digitisation (Push or Pull): Pull demand from the agribusiness.

HS had two business challenges:

- The increased demand for its products from domestic and international markets necessitated expanding its supply chain management system (which was predominantly paper-based and inefficient).
- Food waste due to inadequate inventory and traceability systems. HS required assistance from CASA to transition from a paper-based supply chain and inventory management system to a digital system for procurement, sales, inventory management, order listing, and recordkeeping.

TA provided: CASA contracted IMS Software to develop supply management software to support the company in monitoring accounts, payment transactions, and farmer profiles. In addition, Rumfan developed traceability software for product tracking throughout the supply chain and staff training on using these systems. CASA financed software development for the production management and traceability software, while HS was responsible for financing additional hardware and incorporating tracking codes into packaging.

Immediate benefits: The supply chain management software has simplified payments to farmers and supported the company's vegetable procurement decision-making. The traceability software is reducing produce loss during storage and helping the company to optimise sales and plan future procurement.

CASA TAF

Arohan Foods

Arohan Foods is an Indian pork processor based in Guwahati, Assam, in the Northeastern Region of India.

Category of agri-VAS: Supply-chain management.

Motivation to digitise (Push or Pull): Pull demand from the agribusiness.

Arohan Foods need support in providing better services to smallholder farmers, improving operational efficiency, and in using data to influence policy making.

TA provided: CASA TAF is supporting Arohan in developing and deploying "TapRoute," a fully configurable Software-as-a-Service (SaaS) platform focusing on creating digital farmer profiles, digital pig health cards, pest and disease heat maps, monitoring provision of veterinary services (e.g., vaccinations), and digital markets where farmers can sell their pigs to Arohan.

Immediate benefits: To be determined.

Aliet Green

Based in Indonesia, Aliet Green is a women-owned coconut sugar trader and processor, currently sourcing coconut from about 2,000 female farmers in two villages of Kalon Progo.

Category of agri-VAS: Supply-chain management.

Motivation to digitise (Push or Pull): Pull demand from the agribusiness.

Aliet Green needed to improve operational efficiency and track farmers' activities, including distributing and paying for coconut seedlings.

TA provided: : CASA TAF supports Aliet Green's coconut intensification and rehabilitation initiative by engaging a service provider to develop a Google-based mobile application (AppSheet) and dashboard to manage traceability, procurement, seedling distribution, and loan repayments for seedlings.

Immediate benefits: To be determined

Olivado

Olivado, one of Kenya's major producers of extra virgin avocado oil, currently purchases avocados from approximately 2,500 smallholder farmers

Category of agri-VAS: Supply-chain management.

Motivation to digitise (Push or Pull): Pull demand from the agribusiness.

Olivado needed support in increasing its value chain's operational efficiency, reducing payment errors and financing costs, and strengthening farmer loyalty.

TA provided: CASA TAF contracted a service proavider to leverage tools from the Google Suite – AppSheet for the mobile application and Google Sheets for the back-end dashboards. This platform enabled real-time monitoring of procurement data and streamlined payment reconciliation, reducing the lengthy payment processes for farmers.

Immediate benefits: To be determined.

Kentaste

Kentaste is Kenya's largest coconut processor that sources directly from smallholder producers. Kentaste also offers agronomic training, seedlings, and financing to its smallholders.

Category of agri-VAS: Advisory and information services.

Motivation to digitise (Push or Pull): Pull demand from the agribusiness.

Kentaste needed to improve its operational efficiency, decrease the cost of providing extension services, and enhance the effectiveness of extension service delivery to its farmers.

TA provided:

- CASA TAF facilitated the design and incorporation of digital tools and technology that could complement their existing farmer training activities and potentially contribute to farmers' increased adoption of agricultural practices.
- CASA TAF hired a consultant to support the production of low-cost digital video clips which showed climate-smart agricultural practices and co-created a guide for disseminating these digital video clips.

Immediate benefits: As a result of the use of these video clips, 61% of exposed farmers have adopted at least one improved agronomic practice.

Sucafina

Sucafina is a coffee trader that purchases coffee from the Agricultural Marketing Co-operative Societies in Tanzania (AMCOS).

Category of agri-VAS: Supply-chain management.

Motivation to digitise (Push or Pull): Push demand from the programme.

Sucafina's drive to digitise was to increase the volume of traceable coffee, aligning with global trends demanding more information about product origins, as well as achieve the goal of the Loyalty Programme[14].

TA provided: Embedded within the loyalty programme is a digital solution (CropIn) used to manage and monitor farmers. The broader goal is to use data on farmers' activities from CropIn to enhance AMCOS's access to bank financing and direct extension services to ensure compliance with social and environmental standards.

Immediate benefits: To be determined.

Niche Cocoa Sourcing Limited

Niche Cocoa is a licensed cocoa buying company in Ghana established in 2011.

Category of agri-VAS: Financial access.

Motivation to digitise (Push or Pull): Pull demand from the agribusiness.

Niche Cocoa need help with facilitating the financial inclusion of cocoa farmers they sourced from by digitising payments to ensure that farmers directly receive financial benefits in a safe, efficient, and reliable manner.
TA provided: CASA developed maps for digitising business processes, identified financial services providers and cash-in/cash-out agents, and explored other financial products and services that can be bundled for farmers.

Immediate results: Although the TA discontinued, CASA's support to Niche Cocoa enabled the company to make progress in digitising payments and registering farmers onto the GMoney platform operated by Ghana Commercial Bank, which is the largest commercial bank in the country.

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14 CASA TAF developed a tiered Sucafina AMCOS loyalty programme whereby AMCOS can progress through various tiers based on their accomplishments in financial health, output market engagement, governance, operational efficiency, and loyalty.

ANNEX 3
CASE STUDIES ON CASA'S TA TO MOBILE-BASED AGRI-VAS COMPANIES

COMPONENT A

Pathway Technology

Pathway Technology is the digital technology company that developed GeoKrishi – a mobile application which provides farmers with agronomic, climate and market information.

Category of agri-VAS: Advisory and information services.

Business challenge: Pathway Technology need support to scale-out the adoption of its mobile application (GeoKrishi) to more smallholder farmers.

TA provided: CASA A assisted Pathway Technology in scaling out by marketing its services to farmers. CASA's work with cooperatives in Nepal provided a potential channel to drive the adoption of Pathway's mobile app.

Immediate benefits: Pathway provided training on the use of the Geo-Krishi app to farmers. The intervention has increased farmers' access to extension and advisory information. The app had 700 downloads, but the app currently has 120,000 downloads and is used by 108 community centres and 56 small and medium-sized enterprises. In terms of benefits from using the app, 24.3% of the interviewed farmers increased vegetable productivity, 18% improved pest and disease management and farming techniques, 13% increased access to better markets, while 12% reduced post-harvest losses, according to the CASA Nepal Outcome Assessment 2023.

CASA TAF

DeHaat

DeHaat is one of India's fastest-growing start-ups in the agri-tech industry and one of the few companies providing digital solutions across the entire agricultural value chain.

Category of agri-VAS: Advisory and information services.

Business challenge: DeHaat needed support to expand its service offering to include more value-added services and reach more smallholder farmers.

TA provided: CASA TAF assisted DeHaat in streamlining and expanding its digital service offerings by implementing a physical and digital extension model to provide information on inputs, farm services (e.g., soil testing), and climate adaptation practices. The pilot uses both in-person and digital channels to examine the viability of providing tailored content to farmers. The aim is to develop a scalable, cost-effective model for agricultural extension and service delivery to maximise farmer adoption of improved practices and deliver advice efficiently to farmers.

Immediate benefits: A cost-benefit analysis (CBA) is currently underway. However, the initial results of the CBA do show the digital/physical extension model to have a positive net-present value. The CBA is done on the farmer and company side. On the farmer side, indicators include average farmer yields and average net annual income. The CBA from the company's perspective will rely as much as possible on data shared by DeHaat on expected customer and revenue growth, margins, expenses, and other assumptions as required. The methodology for DeHaat's CBA follows the same principles applied to the farmer-side CBA: benefits will be driven by higher sales to DeHaat's Centers (DCs) while expenditure will increase from the additional costs incurred to onboard and service phygital farmers.

CASA TAF

Farmerline

Farmerline is a Ghanaian agricultural technology company. Farmerline developed Mergdata, a technology platform that provides integrated services and solutions to improve farmers' access to information, agricultural best practices, financial services, and markets.

Category of agri-VAS: Advisory and information services.

Business challenge: Farmerline sought to improve its operational efficiencies, scalability, potential impact, input sales and adoption, and brand loyalty.

TA provided: CASA TAF is supporting a pilot to create an enhanced network of aggregators offering bundled services from input delivery, extension, and crop off-taking. Part of the pilot is to deploy Mergdata (the Farmerline tool) and other digital channels to track the aggregators' sales and operations, which is envisioned to be a transaction history that can also be used to access working capital from Farmerline's financial institution partners.

Immediate benefits: To be determined.