

Information and Communication Technologies

FOR IMPROVING INVESTMENT READINESS OF
SMALL AND MEDIUM AGRIBUSINESSES

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Commercial Agriculture for Smallholders and Agribusiness

The CASA programme is a flagship programme of the UK Foreign, Commonwealth & Development Office (FCDO) and is intended to increase global investment in agribusinesses which trade with smallholders in equitable commercial relationships, increasing smallholders' incomes and climate resilience.

The programme aims to help agribusinesses to scale up and trade in larger commercial markets. As part of its work CASA generates new evidence and analysis that supports a stronger, fairer and greener agribusiness sector.

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List of Acronyms

Agri-VAS	Agricultural Value-Added Services
B2B	Business to Business
B2C	Business to Customer
CASA	Commercial Agriculture for Smallholders & Agribusiness Programme
CTA	Technical Centre for Agricultural and Rural Cooperation ACP-EU
DFI	Development Finance Institution
ERP	Enterprise Resource Planning
F2F	Face to Face
GAP	Good Agricultural Practices
ICTs	Information Communication Technologies
IVR	Interactive Voice Response
MFI	Micro Finance Institution
MIS	Market Information System
MNO	Mobile Network Operator
NA	Not Applicable
NE	Non-Existent
PPP	Public Private Partnership
RCT	Randomized Control Trial
RoI	Return on Investment
SaaS	Software-as-a-Service
SHF	Smallholder Farmer
SME Agribusiness	Small and Medium Agribusiness
SMS	Short Message Service
SW	Software
TA	Technical Assistance
USSD	Unstructured Supplementary Service Data
VAS	Value Added Service(s)

Executive Summary

Information and communication technologies (ICTs) are increasingly seen as an enabler to improve and promote efficiencies in global food market systems, and the high penetration rate of mobile phones is playing a catalytic role in developing countries. Mobile-based agriculture-value-added services (agri-VAS) aim to mitigate the information, financial and market access gaps faced by smallholder farmers and agribusinesses in developing countries. Over the last two decades, the number and variety of agri-VAS has been continuously increasing, and their landscape has been evolving.

However, **many agri-VAS never reach financial sustainability or scale and are discontinued after a few years.** Increasing efforts are being made to map the landscape of agri-VAS targeted at smallholder farmers across Africa and Asia. However, insufficient attention has been paid to exploring successful agri-VAS that have small and medium (SME) agribusinesses¹ as their main clients and that source from smallholder farmers. Areas with potential for further study include the following: a) agribusinesses operating in value chains that are digitized by others (e.g. mobile network operators); b) agribusinesses that are developing and deploying agri-VAS in-house; c) agribusinesses using services provided by third-party agri-VAS providers within their value chains; and d) agribusinesses that develop partnerships with agri-VAS providers to co-develop solutions.

This study aims to address the following question: What are the factors behind successful deployment of mobile technologies to improve agribusiness productivity and investment readiness? It aims to analyse agri-VAS that have SME agribusinesses as their main clients, as they are more likely to positively impact the investment readiness of SME agribusinesses than agri-VAS with smallholder farmers as their only clients, which are also the most evaluated type of agri-VAS.

The study consists of a combination of secondary and primary research, resulting in: a) a set of investment-policy and service-design recommendations, based on high-impact, sustainable agribusiness-focused VAS; b) recommendations on how to improve the body of impact evidence; and c) the identification of investment opportunities at the agribusiness and agri-VAS levels.

Key findings

A broad range of agri-VAS have been conceived with smallholder farmers in mind (e.g. farmer advisory and information services), but fewer have been developed to directly address the needs of agribusinesses (e.g. enterprise resource planning). Out of the six main categories of agri-VAS used in this study, only five have SME agribusinesses as the main client, and out of the 26 sub-categories of agri-VAS, only 14 have SME agribusinesses as their main client. Value-chain integrated² and enterprise resource planning³ VAS are the two sub-categories that are better conceived to: a) address weak value chain connections; b) improve financial access; c) improve agronomic practices; d) improve visibility and transparency throughout the value chain; e) improve farmer management; and f) improve management capabilities of agribusinesses.

Less than a quarter of the agri-VAS with SME agribusinesses as their main clients have conducted some sort of evaluation of their impacts on smallholder farmers or agribusinesses. The majority of those evaluations focus on the impact on farmers rather than agribusinesses. But little effort has been made to evaluate other agri-VAS with greater positive impact potential, such as enterprise resource planning or value-chain integrated services. This is likely to be because commercially-driven agri-VAS are less inclined to invest in impact evaluations and more inclined to focus on increases in their customer base.

¹ The term SME Agribusiness refers to the wide range of small and medium enterprises active in agriculture value chains.

² Agri-VAS that bundle most service categories and cover functions across the whole value chain.

³ Agri-VAS that integrate core agribusiness processes and analytics, value chain intelligence and tools for managing smallholder farmers.

Of the agri-VAS that have SME agribusinesses as their main clients and reach significant scale (over 250,000 users), 61% rely on business-to-business (B2B) revenue as their only income stream, while 7% combine B2B and business-to-consumer (B2C) revenues. Of the 11% of VAS that rely on B2C as their only revenue channel, all charge commissions on their financial services as their main source of revenue. This highlights how **the majority of services reaching scale are either conceived and designed to address a latent market demand from agribusinesses or can get smallholder farmers to pay for financial services.**

Of the agri-VAS service providers interviewed, **58% reported an increase in demand for their services since the beginning of the COVID-19 crisis**, in particular for their roles in facilitating cashflows and access to credit. The ability of agri-VAS to reinforce or develop value-chain connections was also highlighted.

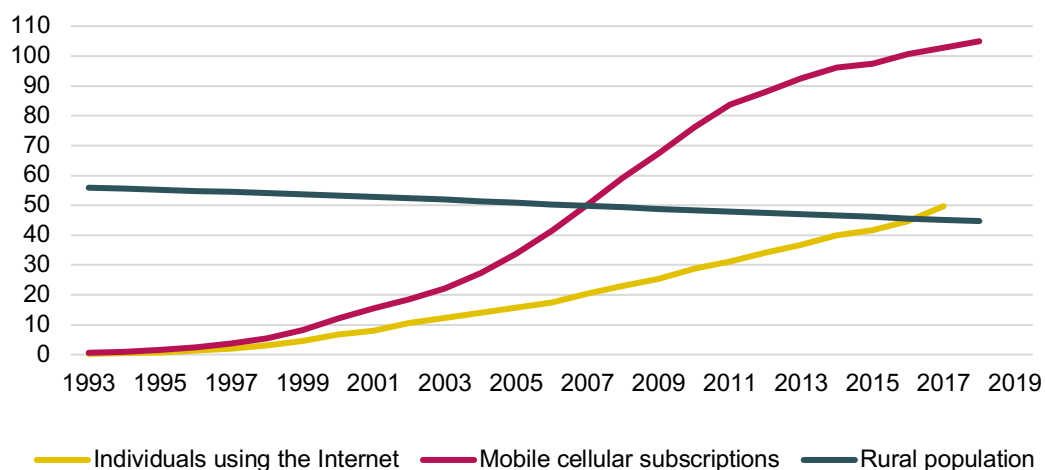
Key recommendations

- Investors, concessional financiers and VAS service providers should understand the different underlying VAS types, service design success factors and business model variations.
- Investors and donors should develop and build on providers that offer enterprise resource planning (e.g. eProd) and value-chain integrated services (e.g. AgUnity).
- To reach financial sustainability, a service should avoid relying on donor or government subsidies. It should allow adaptive pricing aligned with the service offering, which needs to respond to a latent market demand (B2B) or to receive payments from those smallholder farmers who are willing to pay – for financial services, for example (B2C).
- To be replicable and scalable, a provider needs to: a) develop services for different value chains, languages and client requirements; b) build on available technology and focus on user-friendliness; c) promote trust among stakeholders; d) keep investing to improve the offering, processes, technology and increase staff numbers; and e) use strategic partnerships for replication in other geographies.
- Donors and impact investors should support the development and expansion of successful agri-VAS with SME agribusinesses as their main clients and help improve their impact evaluations.
- Investors should consider: a) investing in agribusinesses linked to agri-VAS, which can reduce risks and increase return on investment (RoI), while ensuring socio-economic impact; b) investing in a VAS itself, which can be relatively safe and can increase visibility over investible agribusinesses; c) investing in both VAS and agribusinesses, which combines the advantages of both and means it can help rapidly meet an investee's technical assistance needs.
- The above two recommendations do carry implications for donors and impact investors looking to increase the support they give to Agri-VAS. The complexity and speed at which the landscape of digital technology changes means that a high degree of technical skill is required to understand and select which 'Agri-VAS' services to back. It remains to be seen whether these skills exist within donor organizations and impact investors to the levels required, other than in those most specialized of institutions, and increasing capacity to perform this function effectively will be key for donors and impact investors seeking to invest more in this area.
- Clarity needed to determine the ownership of customer data in different models when considering support or investment.
- COVID-19 presents an investment opportunity for investors to support the scale up of successful and impactful agri-VAS, and for concessional finance to support the cash-flows of affected agribusinesses linked to successful agri-VAS.

1. Introduction

Information and communication technology (ICT) is playing an increasing role in global agriculture, in particular by promoting efficiencies in developing countries with high rates of mobile-phone penetration. Mobile-based agri-value-added services (agri-VAS) aim to mitigate the gaps in information, finance and market access faced by smallholder farmers and agribusinesses. These services follow revolutions in developing-country financial sectors, where mobile-based services have become important enablers for fast-growing economies such as Kenya, Ghana and Indonesia.

Figure 1: Percentage of internet & mobile penetration and rural population globally



Data Source: World Bank (2020)

The rapid adoption of mobile phones at the beginning of the 2000s enabled fishermen in India to access market prices from different ports (Jensen, 2007). This case study triggered a boom in VAS for agriculture, allowing smallholders to access market prices and achieve higher profits, and numerous market information systems (MIS) were launched in the developing world. However, smallholders do not always have the same flexibility as fishermen to choose between different markets. Moreover, these services had high running costs, and farmers were often unwilling to pay for them. As a result, it was hard to make these kinds of services financially sustainable.

In the early 2010s, mobile agri-VAS were mainly financed by non-profit development actors, and the number targeting smallholder farmers directly substantially increased. The services were often classified in three categories: i) information services (e.g. agronomic advice, weather forecasts and market prices); ii) value-chain linkages (e.g. farmers' connections to input providers and markets); and iii) financial services (e.g. savings, credit, weather-index crop insurance and cash transfers). At that time, most of these services struggled to achieve financial sustainability and scale (CTA, 2016), as they were aiming to cover most of their costs through direct revenues from smallholder farmers. But smallholders' willingness to pay for single, non-financial services was quite low, so various services were bundled, and different revenue streams were combined.

In 2020, there are around 400 ICT-enabled agri-VAS just on the African continent (CTA, 2019). More than 33 million smallholder farmers are registered with these services, or 13% of all sub-Saharan African smallholders and pastoralists and up to 45% of smallholder households. However, only 42% of the registered farmers and pastoralists regularly use the agri-VAS they have registered for. **The largest 20 agri-VAS solutions currently account for nearly 80% of all subscriptions, indicating that the industry is starting to prove the sustainability, scalability and impact of certain services and business models.** These 400 agri-VAS can be grouped into six categories, according to CTA: i) agronomic advisory

services; ii) market linkages; iii) financial access; iv) supply-chain management; v) macro agricultural intelligence; and vi) super platforms.

Investments in agri-VAS remain small, and they are primarily driven by donors, as agri-VAS with a development purpose have the potential to fulfil the objectives of development impact at scale and value for money. Private investment is still lagging, as there is not enough clarity about the types of services and supporting business models that can achieve an adequate return on investment as well as a positive developmental impact. CTA estimates annual donor funding flows for agri-VAS in Africa are approximately €175 million, of which 25% comes from private-sector investment. These figures are relatively low compared to the needs of commercial enterprises on the ground and represent a small fraction of the investment flows to agricultural technology in Africa, which were estimated at nearly €1.8 billion in 2017 (CTA, 2019). **The situation is similar in Asia, with the exception of India and China, where there are higher numbers of mature services attracting significant commercial and semi-commercial investments.** Additionally, there are a number of medium and large agribusinesses (e.g. Olam, Syngenta and Cargill) building their own agri-VAS in-house as a way of acquiring long-term competitive advantages in their own captive value chains.

The vast majority of agri-VAS target smallholder farmers directly as clients, users and beneficiaries. A significantly smaller proportion target SME agribusinesses as clients and users, and these source from smallholder farmers, which become users or beneficiaries of the service. Increasing efforts have been made in recent years to estimate the developmental impact of ICT agri-VAS that target farmers directly. But not much analysis has been done to understand how agri-VAS that have SME agribusinesses as their main clients are impacting the lives of the smallholders they source from. And none has been carried out to understand how these VAS are contributing to increasing the investment readiness of agribusinesses.

Table 1: Differences between smallholder and SME agribusiness agri-VAS

	Smallholder agri-VAS	Agribusiness agri-VAS
Client <i>Who pays for the service?</i>	Direct revenue from smallholder farmers and other sources of revenue	Direct revenue from SME agribusiness; potentially also from smallholders and other sources of revenue
User <i>Who uses the service?</i>	Smallholder farmers	SME agribusinesses and smallholder farmers
Beneficiary <i>Who receives the impact of the service?</i>	Smallholder farmers	SME agribusinesses and smallholder farmers

Gender divide in agri-VAS

About 40–50% of smallholder farmers in sub-Saharan Africa are women, but only 25% of mobile-based agri-VAS users are women (CTA, 2019). In recent years, a number of donor-led VAS have been developed aiming to promote women’s empowerment in food systems and improved nutrition for women and children. However, these services have rarely fulfilled their goals due to the disconnect between mobile ownership, access and the actual users of the services provided (Huggins & Valverde, 2018). Agri-VAS with SME agribusinesses as their main clients can overcome this disconnect through alternative means of communication, such as face-to-face. Agribusinesses can use these to pass on information to the farmers they source from and ensure that women benefit from the positive impacts of the agri-VAS.

2. Objectives and outline of methodology

Research question and objectives of the study

The goal of this study is to address the following question: What are the factors behind the successful deployment of mobile technologies to improve agribusiness productivity and investment readiness?

The specific objectives of the research, as defined by the terms of reference, are to:

- Identify and categorize agri-VAS (according to type of agribusiness, service category and business model) that have SME agribusinesses as their main clients and that source from smallholder farmers.
- Rank existing VAS on their potential to increase the investment readiness of small and medium agribusinesses.
- Analyse supporting business models of the top-ranked VAS for agribusinesses and identify key factors for them to achieve financial sustainability, scalability and replicability.
- Assess the extent to which the top-ranked VAS tend to include or exclude more-marginalized groups and their potential for reducing or exacerbating social, economic and technological inequalities.
- Identify and recommend private and public investment opportunities in agribusiness VAS which could magnify the impact of existing services, increase their financial sustainability and scale, and promote an enabling technology-vendor landscape that would allow these services to proliferate.

Scale of the evidence used

A review was conducted of all ICT-based agri-VAS listed in CTA's Digitalization of African Agriculture Report (CTA, 2019) and Grow Asia's Digital Directory (Grow Asia, 2020). These are acknowledged as the most comprehensive and up-to-date information sources on the agri-VAS landscape in sub-Saharan Africa and South Asia. Out of all the agri-VAS listed in these two sources, this study identified and analysed a total of 104 that focus directly on SME agribusinesses. All of these were evaluated and ranked against five criteria: service offering; potential for financial sustainability; current scale; impact on agribusiness investibility; and the quality of the existing evidence. The study interviewed 19 out of the 27 top-scoring agri-VAS.

Study limitations

This study acknowledges the speed at which the landscape of digital technology changes, which means that programmes, directories and research often struggle to keep abreast of the changes. It recognizes that the data gathered from secondary sources is often dependent on service providers self-reporting at a particular point in time, and the study therefore depends on the rigorousness and reliability of the data available. It also acknowledges the increasing number of businesses offering optimized suites of applications (apps) tailored to agribusiness SMEs in developed markets. Due to limitations of time and resources, it was not possible to carry out a comprehensive analysis of SME agribusiness apps in developed markets with potential for expansion to sub-Saharan Africa and South Asia.

Outline of methodology

Approach

Because of the limited availability of high-quality secondary data on the specific case studies and the analysis of their impact, this study combined secondary evidence with primary research. The research has been structured as follows:

Table 2: Research structure

Secondary research	<ul style="list-style-type: none"> • Landscape study of existing mobile-based agri-VAS that have SME agribusinesses as their main clients in sub-Saharan Africa and South Asia. This includes categorization of the VAS, analysis of their service offerings and descriptions of their business models. (See Annex 1.) • Identification of existing evidence evaluating how each agri-VAS contributes to increasing the investment readiness, impact, inclusivity and scale of agribusinesses, as well as its development impact at the smallholder-farmer level. (See Annex 1.)
Analysis of secondary data	<ul style="list-style-type: none"> • Evaluation of the quality (rigorousness and strength) of the body of evidence. • Elaboration of preliminary conclusions based on the analysis of secondary data. • Ranking of the VAS and selection of the top-ranking services on which to conduct primary research and complete information gaps so that further conclusions can be drawn.
Primary research	<ul style="list-style-type: none"> • One-hour interviews with members of the executive teams of the top-ranked VAS to better understand the factors behind the successful deployment of mobile technologies and increase agribusiness investibility and farmer impact. These include: the supporting business model that helps to achieve financial sustainability, scale and replicability; the impact of the service at the agri-input and off-taker levels (both economic benefits and reduced investment risks); the socio-economic and environmental impacts of the service; and the opportunities and constraints emerging from the COVID-19 pandemic.
Analysis of primary data	<ul style="list-style-type: none"> • Curation, analysis and identification of conclusions from the primary research. • Identification of how agribusiness-focused VAS can contribute to increasing the pipeline of investible agribusinesses and reducing investment risks for SME agribusinesses investors.
Conclusions and recommendations	<ul style="list-style-type: none"> • Recommendations on how to improve the quality of the secondary evidence. • Policy and service design recommendations to build on successful examples of high-impact and sustainable agri-VAS. • Identification of investment opportunities in agri-VAS.

Segmentation rationale

An initial review of the state of the evidence highlighted the absence of widespread agreement on the categorization of mobile based agri-VAS. The sector has been in constant evolution, and it is highly competitive. So, in order to keep abreast of the agriculture innovation curve, donors, academics and experts have categorized agri-VAS in their own, unique ways – e.g. differentiating between services according to the technologies used or by their applications at different points in the value chain.

Table 3: Categorization of agri-VAS by various organizations

Organization	Mobile-based agri-VAS categories	
GSMA	1. Information services 2. Digital profiles 3. Internet-of-things applications for agriculture	4. Mobile money 5. Track-and-trace farm management systems 6. Agribusiness analytics
ISF Advisors	1. Information services 2. Market access	3. Supply-chain efficiency and smart logistics 4. Financial services
Grow Asia	1. Farmer extension and training 2. Supply-chain intelligence	3. Product traceability 4. Digital financial services
CTA	1. Advisory & information services 2. Market linkages 3. Financial access	4. Supply-chain management 5. Macro-agricultural intelligence 6. Super platforms

Instead of developing a brand-new categorization, this paper adopts the six categories used by CTA. This categorization is particularly relevant for the study, as it classifies agri-VAS based on their applications in the value chain, which facilitates the identification of both agribusinesses and smallholders as clients, users and beneficiaries. The following table provides definitions of each of these six categories:

Table 4: Selected service categories

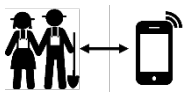

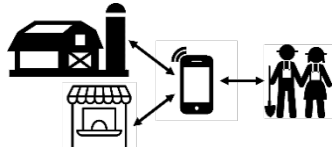
Category	Definition
Advisory & information services	Information and advice on good agronomic practices, pest and disease diagnosis and management, market prices, weather forecasts, and more-sophisticated digital advisory services.
Market linkages	Platforms that link smallholders to farm inputs, to services for production and post-harvest machinery and mechanization and to off-take markets – including agri-dealers, wholesalers, retailers and end-consumers.
Financial access	Services targeted at smallholders such as digital payments, savings, credit, and agricultural insurance. This category also includes business-to-business digitalization and data-analytics services for financial institutions.
Supply-chain management	Business-to-business services that help agribusinesses, cooperatives, nucleus farms, input agri-dealers and other value-chain intermediaries to manage their businesses and smallholder relationships.
Macro-agricultural intelligence	Data-analytics and decision-support tools that integrate a range of data sources on smallholders, farms and markets. The tools transform this information into insights at country and value-chain level, as well as decision-tools for government policymakers, extension agencies, agronomists, agribusinesses and investors.
Super platforms – value-chain integrated services	CTA uses the term “super platforms” for agri-VAS that integrate the previous five categories of services and cover functions along the whole value chain. This term places the emphasis on the technology used instead of its thematic or holistic coverage. Therefore, this analysis suggests renaming this category “value-chain integrated services”, which highlights its relevance to the whole smallholder value chain.

Each of the six categories includes a number of service sub-categories, referred to as “service offerings” in Annex 1. Agri-VAS can have smallholders (SHFs) as their only clients, SME agribusinesses as their main clients or both smallholders and SME agribusinesses as their main clients.

Agri-VAS that have smallholders as their only clients can have positive developmental impacts at the smallholder level, but their contribution to increasing agribusiness investment readiness is exceptionally difficult to evaluate for three main reasons. a) Agri-VAS providers

that do not have SME agribusinesses as clients do not evaluate their impact at the agribusiness level, which is at the heart of this study's research. b) Agri-VAS that have smallholders as their only clients will have a significant proportion of customers that are not connected to off-takers. c) It is particularly challenging to attribute an impact on SME agribusiness investment readiness to an agri-VAS if the SME agribusiness is not connected to the service and if only a small proportion of the smallholders supplying the agribusiness are connected to it. Most existing research into the impact of mobile-based agri-VAS has concentrated on understanding the impact of services at the smallholder farmer level.

Table 5: Agri-VAS impact potential

	VAS for SHFs	VAS for SMEs	VAS for SHFs and SMEs
Model			
Impact Potential	Impact on smallholders	SME agribusiness investibility and profitability	Impact on smallholders and SME agribusiness (agri-input dealers or off-takers) investibility and profitability

Agri-VAS that have SME agribusinesses as their main clients can contribute to increasing their investment readiness. The services can improve SME agribusinesses' sourcing from smallholders through better financial management, accountability, marketing and internal communications, thus making them more efficient and increasing their business management capacity.

Agri-VAS that have both smallholders and SME agribusinesses as their clients use ICTs to promote information and financial flows between agribusinesses and numerous smallholders, who are not part of agri-businesses but do supply to them. These solutions leverage technology to reduce the costs and risks associated with sourcing from, selling to and communicating with smallholders. They also promote efficiencies and improve value-chain transparency through greater traceability. In addition, the services increase the quality and quantity of smallholder supply, as well as smallholders' yields and incomes, by making it easier for commercial players to formally engage with smallholder farmers.

It is also important to understand how an agri-VAS relates to an SME agribusiness. The relationship depends on the type of VAS provider and how it deploys its services. The main categories include:

- Agribusinesses operating in value chains that are increasingly digitized by other actors, through government-led or B2C models, in ways that benefit the agri-business (e.g. using mobile money for market payments such as M-Pesa in East Africa);
- Agribusinesses that are directly developing and deploying different types of solutions in-house (e.g. proprietary services such as Olam or Cargill);
- Agribusinesses that are engaging with third-party VAS providers to directly deploy VAS in their value chains as B2B customers;
- Agribusinesses that are selectively developing partnerships with VAS providers to co-develop solutions with the possibility of acquiring the services later. The following table analyses which service categories and sub-categories have smallholder farmers (SHFs) as their only clients, which have SME agribusinesses (SMEs) as main clients and which have both as main clients:

Table 6: VAS categories and sub-categories with SME agribusinesses as main clients

VAS categories	VAS sub-categories	Clients	
		SHFs	SMEs
Advisory & information services	Agronomic/livestock good management practices		
	Market information systems and services (e.g. agri-inputs and crop/livestock price intelligence)		
	Early-warning and forecasting tools for weather/climate advisory and pest/disease control		
	Customized (precision) advisory services at the level of farmer, farm or specific field		
	Participatory platforms (e.g. peer-to-peer smallholder communities or curated farmer videos)		
Market linkages	Linkage to agri-inputs (e.g. digitally enabled input distribution, online input marketplaces)		
	Linkage to market access (e.g. digitally enabled linkages to agribusinesses or wholesale buyers)		
	End-to-end integrated market linkage models (e.g. digital linkage to both inputs and markets)		
	Mechanization access services (e.g. sharing economy for mechanization, pay-as-you-go irrigation)		
	Agri buyer-seller digital marketplaces/exchanges		
Financial access	Smallholder farmer payment solutions (e.g. agribusiness to farmer or farmer to input supplier)		
	Digital agri-wallets and commitment savings systems		
	Smallholder credit (e.g. digital credit assessment/delivery/ collection platforms and products)		
	Smallholder insurance (e.g. digitally enabled indexes for weather, precipitation and pest insurance)		
	Crowdfunding platforms for smallholder farming		
	Business-to-business fintech data-analytics intermediaries (e.g. digital credit profiles)		
Supply-chain management	Traceability solutions (e.g. digital sustainability and organic product certification tracking)		
	Enterprise resource planning (ERP) platforms for smallholder farmer cooperatives, nucleus farms and agribusiness out-grower schemes		
	Digital quality-assurance solutions for farm inputs and produce		
	Logistics-management solutions, storage and transport		
Macro-agricultural intelligence	Government agriculture-sector tracking dashboards		
	Agriculture extension-system management tools		
	Agribusiness and agriculture-investor national and regional intelligence systems		
	Agronomy/R&D agenda-setting digital tools		
	Weather and climate observatories for agriculture		
Value-chain Integrated services	End-to-end solutions that cut across all other categories		

Advisory and information services are the only category that has smallholder farmers as the only clients, with no SME agribusiness clients. This is mainly due to the content of these services and the nature of the service providers, which tend to be led either by government or not-for-profit organizations instead of the private sector. These services' business models and likelihood of achieving financial sustainability tend to be more challenging than those of VAS that bundle multiple services. However, most of the other categories include an advisory-service dimension either as a post-sales support service or as a way to secure the right quality and quantity of produce for the agribusiness.

Quality of the impact evidence

Traditional quality appraisal frameworks classify individual studies into low, medium and high quality. This study uses a traffic light system and adds two additional levels: low quality (self-reported), for when a service provider claims to have an impact but does not provide

supporting evidence, making it difficult to discern actual from desired impact and marketing strategies; and non-existent, as a lack of evidence is highly relevant for the purpose of this analysis.

Table 7: Quality appraisal classification

High quality	Impact assessments or research studies with a strong conceptual framework and methodology, as well as validity, strong analysis and strong results.
Medium quality	Impact assessments or research studies with weaknesses in the conceptual framework, methodology, validity, analysis or results.
Low quality	Studies that lack rigour and base their conclusions on anecdotal evidence.
Low quality (self-reported)	Statements made by the VAS provider about its impact. Information regarding the methodology used for the evaluation is lacking.
NE	Non-existent: no information regarding the impact of the service.

VAS ranking based on potential to increase agribusiness investment readiness

Based on the findings from the secondary research and given the limited current evidence on the impact of services on agribusiness investibility, this analysis uses five indicators to rank services' potential to have a durable and scalable impact:

Table 8: Scoring framework to assess agri-VAS

Indicator	Scoring
Service offering - Indicates the likelihood that the service will successfully provide economic benefits and reduce the investment risks of stakeholders (agri-input dealers, off-takers and farmer), as well as increase customer willingness to pay.	2 = offers all potential sub-services within one VAS category
	All the other scores are calculated by dividing the number of subservices offered by the VAS (x) by the number of subservices in one category (y) and multiplying by 2: $x/y * 2$
Potential for financial sustainability -Indicates the potential durability of the service over time and contributes to de-risking investments linked to the services.	2 = at least one commercial partner behind the service and no dependency on donor funding
	1 = either a non-commercial partner running the service or dependency on donor funding
	0 = a non-commercial partner running the service and dependency on donor funding
Current scale - Indicates the stage of development and commercial potential of the service, as well as its integration into existing market and food systems, where it can provide economic benefits at scale.	2 = over 50,000 clients
	1 = between 5,000 and 50,000 clients
	0 = fewer than 5,000 clients
Impact on agribusiness investibility - Independently of the quality of the evidence, this indicator shows which VAS have been conceived with the idea of increasing agribusiness investment readiness.	2 = indication of increased economic benefits & reduced investment risks
	1 = indication of either increased economic benefits or reduced investment risks
	0 = no current indication that the service contributes to increasing investment readiness
Quality of evidence - Indicates which VAS have proven to have a positive impact on agribusiness investibility.	2 = High quality
	1.5 = Medium quality
	1 = Low quality
	0.5 = Low quality (self-reported)
	0 = NE
Maximum score = 10	

3. Defining successful deployment of mobile-based agri-VAS

During their early days, mobile-based agri-VAS struggled to achieve financial sustainability and scale, and the vast majority did not survive beyond the pilot phase (CTA, 2016). This is starting to change, and a number of agri-VAS are achieving sustainability and scale. However, a successful agri-VAS business proposition is not necessarily the same as a service that has impact from a development point of view. Therefore, this study examines successful business models and successful development impacts separately.

Defining successful agri-VAS business models

Financial sustainability

This study defines financial sustainability as the capacity of an agri-VAS to sustain its provision of services without depending on external grants or donor funding. The proven or projected capacity of a service to break even (that is, cover the operating costs of running the service) is considered in this study as the threshold for financial sustainability. The service's current and projected capacity to generate profits is considered a determining factor in its investment readiness.

The supporting business model and, in particular, its cost and revenue structures are the key determinants for an analysis of the financial sustainability of an agri-VAS. This study acknowledges the difficulty of obtaining relevant and reliable data about services' cost-revenue structures, and it will use proxies for its analysis, such as the diversification of revenue streams.

Revenue modalities considered include:

- **B2C**: Direct client revenue – e.g. user or subscription fees, freemium models, mark-up or commission fees;
- **B2B**: Direct business-to-business revenue – e.g. advertizing revenue or payment to access the service by agribusinesses, lead firms or agribusinesses;
- **B2C and B2B**: Direct revenue hybrid – e.g. revenue from smallholder farmers as well as enterprise customers;
- **Subsidized**: Reliance on grants – e.g. donors, NGOs or corporate social responsibility budgets fund the service, which is mainly driven by developmental goals;
- **B2C and subsidized**: Direct client revenue but dependent on government or donor funding;
- **Indirect benefits**: e.g. the VAS helps the service provider increase its customer base and loyalty, or the user data gathered through the service is sold or capitalized on by the service provider.

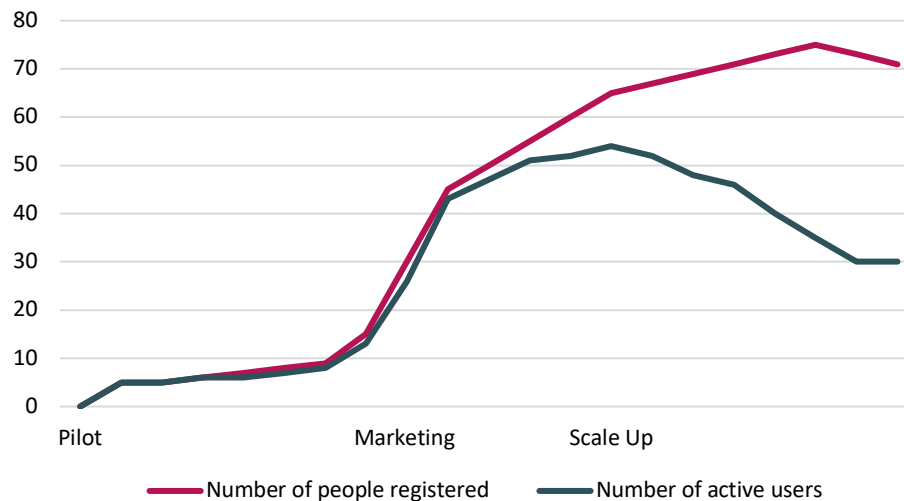
It is also worth acknowledging that, to be financially sustainable, a VAS will need to be able to adapt its pricing model to customer profiles, the level of customization required and geographical location. The pricing model should also vary according to the partnership model needed to implement the service in a given location.

Scale

For the purpose of this analysis, the concept of successfully achieving scale is divided in four sub-categories:

- **Number of users registered:** The capacity of the agri-VAS to achieve a large number of subscribers by being able to register a high proportion of the target market to the service.
- **Number of active users:** Not always published by VAS, this figure relates to a service's user retention rate and number of monthly active users. As illustrated in Figure 2 below, the number of registrations does not equate to the number of active users: only 42% of the agri-VAS registrations in Africa are active users.

Figure 2: Typical mobile agri-VAS customer journey evolution



Source: GSMA (2015)⁴

- **Replicability of the service:** This is the ease of scaling the agri-VAS by replicating its services in different geographies. It relates to the technical complexity of the service and its dependency on the enabling environment and supporting infrastructure. This sub-category will be analysed separately in this study, as not all scalable VAS are replicable, though most replicable services are scalable.
- **Scale through diversification:** The capacity of the service provider to expand the service offering to include new solutions in order to achieve scale and retain customers. This is part of the expansion and investment plans of most VAS, and it is commonly acknowledged as a prerequisite for maintaining the relevance of a VAS.

Defining successful agri-VAS impact models

As described in the introductory section of this study (Table 1), the users, clients and beneficiaries of an agri-VAS might not be the same. It is therefore paramount to understand the developmental impact of the service at the beneficiary level. For the case of agri-VAS that have SME agribusinesses as their main clients, the two main beneficiaries are the SME agribusinesses (which are clients and users too) and smallholder farmers (which might also be service users).

SME agribusiness impact

The term SME agribusiness refers to a diverse range of small and medium enterprises conducting a range of activities in agriculture value chains – on farms, off farms and between farms and their off-farm partners. These activities encompass crop cultivation, animal

⁴ Graph consolidated through conversations with industry actors about conventional thinking on the shape of the Agri-VAS customer journey.

rearing, input supply, agri-processing, food manufacturing, merchandizing, exporting and retailing. They also include the operations of specialized service providers that support core agri-processors with transportation, finance, information and other critical farm-support services. This study mainly concentrates on agri-input dealers and off-takers to analyse the impact of agri-VAS. The impact at the agribusiness level has three dimensions:

- **Investment readiness**, derived from:
 - Increased economic benefits: efficiencies and reduced management costs; greater quantity of supply (through increased productivity and reduced losses); higher profit margins; and higher quality of supply, including the end product complying with market requirements.
 - Reduced investment risks: improved business management skills (including bookkeeping); increased operational transparency; improved access to markets and customer outreach; increased farmer aggregation; increased access to finance; greater value-chain interconnectedness; and reduced vulnerability to shocks (e.g. price and weather changes).
- **Socio-economic inclusiveness** – in particular of women, youth and marginalized communities.
- **Environmental footprint** – such as lower carbon emissions.

Developmental impact at the smallholder farmer level

The vast majority of mobile-based agri-VAS studies concentrate their analyses on services with smallholder farmers as the main clients, and they are designed around the needs of smallholders (World Bank, 2017a). Therefore, they analyse the dimension of users' socio-economic empowerment, as the users are also the beneficiaries of these services (smallholder farmers). However, this study analyses agri-VAS of which the main clients are SME agribusinesses who have a positive developmental impact beyond the agribusinesses themselves. The impact at the smallholder farmer level is divided here into five potential dimensions (CGAP: 2020):

- **Increased income** through income diversification, improved farm productivity, reduced crop losses, better financial access, higher prices or quality inputs. This is probably the most commonly reported impact at the smallholder farmer level and it is often mistakenly used as a proxy to claim positive impacts on socioeconomic inclusion and even nutritional outcomes. Increased income does not necessarily translate into better nutritional outcomes or greater inclusion, unless there are specific efforts towards those goals, such as ensuring women's control over income.
- **Economic inclusion**, through smallholder farmers engaging more in commercial supply chains through secured harvest demand and agribusiness employment opportunities. Agri-VAS often claim to have an impact in this dimension through the creation of employment opportunities.
- **Social inclusion**: women and youth participate more in income-generating activities and gain access to agronomic advice, finance and inputs. The current technological access divide can exacerbate gender inequalities, so it is necessary to design agri-VAS in a holistic manner and in a way that empowers women.
- **Improved climate resilience**, through improved weather forecasts and climate-smart agricultural practices. Agri-VAS that offer advisory services and promote the adoption of good agricultural practices (GAP) often claim to have an impact in this dimension. But it is not clear the extent to which GAPs promote climate resilience.
- **Improved nutritional outcomes** from growing and then consuming higher-quality crops. This is probably the most difficult impact dimension to assess, because it is difficult to attribute an impact to a single intervention. Only rigorous analysis extending over a significant period of time should be considered when evaluating the nutritional impact of agri-VAS at the smallholder farmer level.

Impact of COVID-19 on mobile-based agri-VAS

In May 2020, the CASA programme organized an eConference series: “Rethinking Agri-Business Investments Through the Pandemic”. It brought together a range of investors and investment support stakeholders to analyse the following: the impact of COVID-19 on agribusinesses in developing countries; investors' support for agribusinesses during the COVID-19 pandemic; rebuilding value chains with food-safety and environmental standards after the pandemic; and future scenarios and agribusiness investment opportunities after COVID-19.

Some of the main outcomes from the discussions were about how technology, including mobile-based agri-VAS, can help increase the resilience and visibility of supply chains and food systems, as well as create new investible business models.

Quotes from CASA’s “Rethinking Agri-Business Investments Through the Pandemic”

“The big thing for us is the role that technology can play in helping connect us with the smallholders and those communities and indeed the work we do in managing long-term contracts”
Judith Batchelar, Director of Sainsbury's Brand, Sainsbury's

“Technology is changing everything...and at Root Capital we think that the lockdown will accelerate all of this”
Steve Nocka, Chief Lending Officer, Root Capital

“We have seen that value chains and smallholders that are part of the digitalization have been much more resilient than people who are not part of this, even by receiving facilities of payment or just information on where they can deliver and when”
David Laborde, Senior Research Fellow, International Food Policy Research Institute (IFPRI)

“There has been a shift from the traditional supply chain to this more digitally-enabled start-up supply chain that has been building, a few years in the making, but it is suddenly having its moment... It seems like this pandemic is an incredible catalyst”
Mark Kahn, Managing Partner, Omnivore Venture Capital

This study went beyond its core research objectives to investigate topics related to COVID-19. (See the section, “Research question and objectives of the study”.) Based on the disruptive nature of the pandemic and the main takeaways from the “Rethinking Agri-Business Investments Through the Pandemic” eConference, the study used primary research to explore:

- The impact COVID-19 is currently having on demand for agri-VAS
- Its impact on the overall activity of service provision (e.g. changes in the supply and demand of services and transactions)
- The potential of certain agri-VAS to contribute to reducing negative impacts of the pandemic at the smallholder and agribusiness levels
- Potential uses of agri-VAS to promote the resilience of agribusinesses and smallholder farmers in light of the pandemic

4. Agri-VAS deep dive

Agri-VAS Selection

All the 104 agri-VAS analysed in this study were evaluated and ranked against five criteria: service offering; potential for financial sustainability; current scale; impact on agribusiness investibility; and existing quality of evidence. A total of 27 VAS scored 7 or more points out of 10, and those services were selected for further analysis.

Table 9: Top ranked agri-VAS

Category	Top scoring VAS (scores >7)	Individual score	Average score in category ⁵
Input market integrators (2 VAS ~ 25% of the total in the category)	Babban Gona	7.1	6
	DigiFarm	7.1	
Off-take market integrators (2 VAS ~ 25% of the total in the category)	Farmshine	7	5.4
	Selina Wamucii	7.7	
Integrated end-to-end market linkages (1 VAS ~ 10% of the total in the category)	Tulaa	7	5.3
Agriculture e-marketplaces (2 VAS ~ 18% of the total in the category)	LimaLinks	7.9	4.8
	e-Nam	7.1	
Smallholder payment solutions (0 VAS scored > 7, out of 4 in this category)			3.8
Traceability and certification solutions (3 VAS ~ 43% of the total in the category)	Source Map	7.6	5.6
	NamLITS	7.4	
	GeoTraceability	7.4	
Enterprise resource planning (12 VAS ~ 40% of the total in the category)	OFIS	8.8	6.1
	Connected Farmer	7.9	
	eProd	7.6	
	FarmCloud	8.1	
	Agreo	8.1	
	Farmforce	7.8	
	CropIn	7.8	
	SourceTrace	7.8	
	Rural Sourcing Management	8.3	
	Metajua	7.6	
	AgriGO	7.1	
Agrio	7.4		
Digital quality assurance and anti-counterfeiting (0 VAS scored > 7, out of 4 in this category)			4.3
Logistic management solutions, storage and transport (1 VAS ~ 25% of the total in the category)	Virtual City	8.1	5.2
Macro agricultural intelligence (0 VAS scored > 7, out of 7 in this category)			5.2
Value chain integrated VAS (4 VAS ~ 36% of the total in the category)	Farm to Market Alliance	7.5	6.6
	Rural Taobao	8.0	
	Farmerline	9.5	
	AgUnity	8.5	

This study interviewed 19 out of the 27 VAS scoring 7 or higher, with representation from the six top-scoring categories: value chain integrated VAS; enterprise resource planning; input market integrators; traceability and certification solutions; off-take market integrators; and integrated end-to-end market linkages.

Key findings

Scalability

The capacity of a VAS to scale up and retain customers is of critical importance to its impact potential. Just over 50% of the VAS service providers interviewed reach more than 250,000

⁵ VAS for which information about the business model is lacking have been excluded in the calculation of the category average, helping reduce the standard deviation

farmers; 37% reach between 50,000 and 250,000; and only 11% reach fewer than 50,000 farmers. There is only one VAS (DigiFarm) reaching more than 250,000 farmers that does not fall in the ERP category of services.

Fourteen out of the 19 service providers interviewed engage with agribusinesses as third-party VAS providers that directly deploy services to agribusinesses in specific value chains. Two out of the 19 are run by a mobile network operator (MNO – Vodacom’s Connected Farmer and Safaricom’s DigiFarm) and are contributing to digitalizing value chains in which agribusinesses operate; this facilitates customer acquisition for the agribusinesses, as farmers are already customers of the MNO. One service provider, Olam’s OFIS, is an agribusiness that is directly developing and deploying different types of ICT-based solutions in-house. It is a proprietary service, which has major implications for its positioning, model, path to scale and impact; its expansion just depends on the capacity of the company to integrate the service into its business lines in response to demands from its own clients, such as Nestlé. Another of the 19 service providers is a government-owned service, Namibia’s NamLITS. Farms in the country are obliged to use it. And one VAS provider, Farm to Market Alliance, has a partnership with agribusinesses that presents scalability challenges, so the model needs to be adapted to the specific requirements of the agribusinesses.

The following list covers the main recommendations for successful service expansion that emerged from the interviews:

- Service development should address existing demand for services, instead of trying to create a demand for a new service
- The service should be flexible – adaptable to different value chains – and it should be easy to integrate with other systems
- The VAS must build on available technology and have a user-friendly interface
- The information should be available in local languages to ensure knowledge uptake and customer retention
- A private organization should be the lead partner (or at least one of the key partners), as this will help to achieve scale
- Trust among the VAS’s stakeholders will help customer retention
- Investment needs to be continuous in order to improve the service offering, processes and technology and to increase staff numbers

Replicability

The scalability of a service is not necessarily related to its replicability. For example, an MNO-led service can be highly scalable within one country but difficult to replicate in other countries if the MNO is not present. In the case of proprietary services (e.g. Olam’s OFIS), it is much more straightforward to replicate the service: the company operates across multiple countries and commodities, and being able to adapt the service to the value chain and local languages becomes the main requirement for replication. Of the VAS interviewed, 47% are present in four or more countries; 21% have a footprint in two or three countries; and another 32% are only present in one country.

The main factors behind successful replicability are:

- Having a highly customisable service that can be adapted to user needs, including value chains and local languages
- The ease with which the service can be integrated into other systems, such as banking
- Building on strategic partnerships for replication in other geographies
- Developing locally adaptable business models such as franchising

Financial sustainability

Making a profit, or at least breaking even, is without doubt one of the main challenges faced by mobile-based value-added services, and the vast majority of VAS never go beyond the pilot phase. Of the VAS interviewed, 58% reported that they are currently making a profit; 26% expect to break even over the next two years; 11% are revisiting their service model in order to become financially sustainable; and 5% depend on government subsidies and are not seeking to achieve financial sustainability. It is worth paying attention to Olam's OFIS, which is not making a profit but it is benefiting Olam by improving its supply quality and compliance, as well as allowing Olam to access a vast amount of farmer data.

The main success factors highlighted for achieving financial sustainability are:

- 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
- Redistributing the cost of running the service across different for-profit business lines

Agribusiness impact

As indicated by the analysis of the existing body of evidence, it is difficult to obtain full clarity about the actual impact of a VAS based on rigorous evaluations or impact projections. Thirty-two per cent of the interviewees indicated that they have not fully evaluated the impacts (economic benefits and reduced investment risks) of their VAS at the agribusiness level, while the rest provided some estimates. The vast majority of impact evidence is generated at the off-taker level, while information on agri-input dealers is often lacking.

VAS that have reached scale, deliver a geographical footprint in more than three countries and are financially sustainable report the following impacts:

- **Agri-input dealer:**
 - Reduced investment risks: increased customer outreach; increased business management skills; and increased visibility of farmer data
 - Economic benefits: increased efficiencies; reduced marketing costs; and increased sales
- **Off-taker:**
 - Reduced investment risks: increased business management skills; increased operational transparency; increased farmer aggregation and farmer loyalty; increased access to markets; increased creditworthiness
 - Economic benefits: increased efficiencies, reduced management costs and increased profits; increased quantity, quality and compliance of the supply

Socioeconomic and environmental impacts at the farmer level

All but one (AgriGO) of the agri-VAS interviewed provided estimates of their impacts at the farmer level. The majority of the impacts reported relate to the economic impact of the services on farmers. This conclusion aligns with the secondary research reported in the previous section of this study. The following impacts are reported by VAS that have reached scale, have footprints in over three countries and are financially sustainable:

- **Economic**: increased productivity; reduced costs; and increased profits.
- **Inclusiveness**: the percentage of women reached by the services at the farmer level is significantly higher than that of women reached at the agribusiness level. Only

those services that explicitly target women-led value chains and aim to empower women at all levels have women as more than 50% of their customers.

- **Environmental:** the impact of services on carbon emissions is rarely reported. It primarily results from the promotion of less-polluting agri-inputs. In some cases – for example, when compliance with standards is required – practices to combat deforestation are also reported.

Impact of COVID-19

Fifty-eight per cent of the VAS interviewed reported increased demand for their services since the beginning of the pandemic, and some mentioned the increased availability of funding for COVID-19 mitigation through the use of new technologies. The potential of these services to facilitate cash flows and access to credit during and after the pandemic has been highlighted as one of the main contributions to addressing challenges in food systems related to COVID-19. (See also takeaways from the eConference series, “Rethinking Agri-Business Investments Through the Pandemic”.⁶) Another key contribution of these services to coping with the negative impacts is to reinforce or develop value-chain connections (agri-input – farmers – off-takers – transporters – buyers). But some VAS reported that pre-existing users have slowed down or stopped their use of services due to government-imposed regulations.

Investment needs

Most of the interviewees highlight the need for additional investment to improve their service offering, processes or technology, and so increase their service’s scale and sustainability. Some said that additional investments in agribusinesses linked to their service could help deepen its impact. Also highlighted was the importance for social impact investors to properly understand the complex environment in which these VAS operate and the need to adapt their investments and expectations to those challenges. They should do this through: bigger ticket sizes, more-patient capital, and lower expectations of return on investment (RoI).

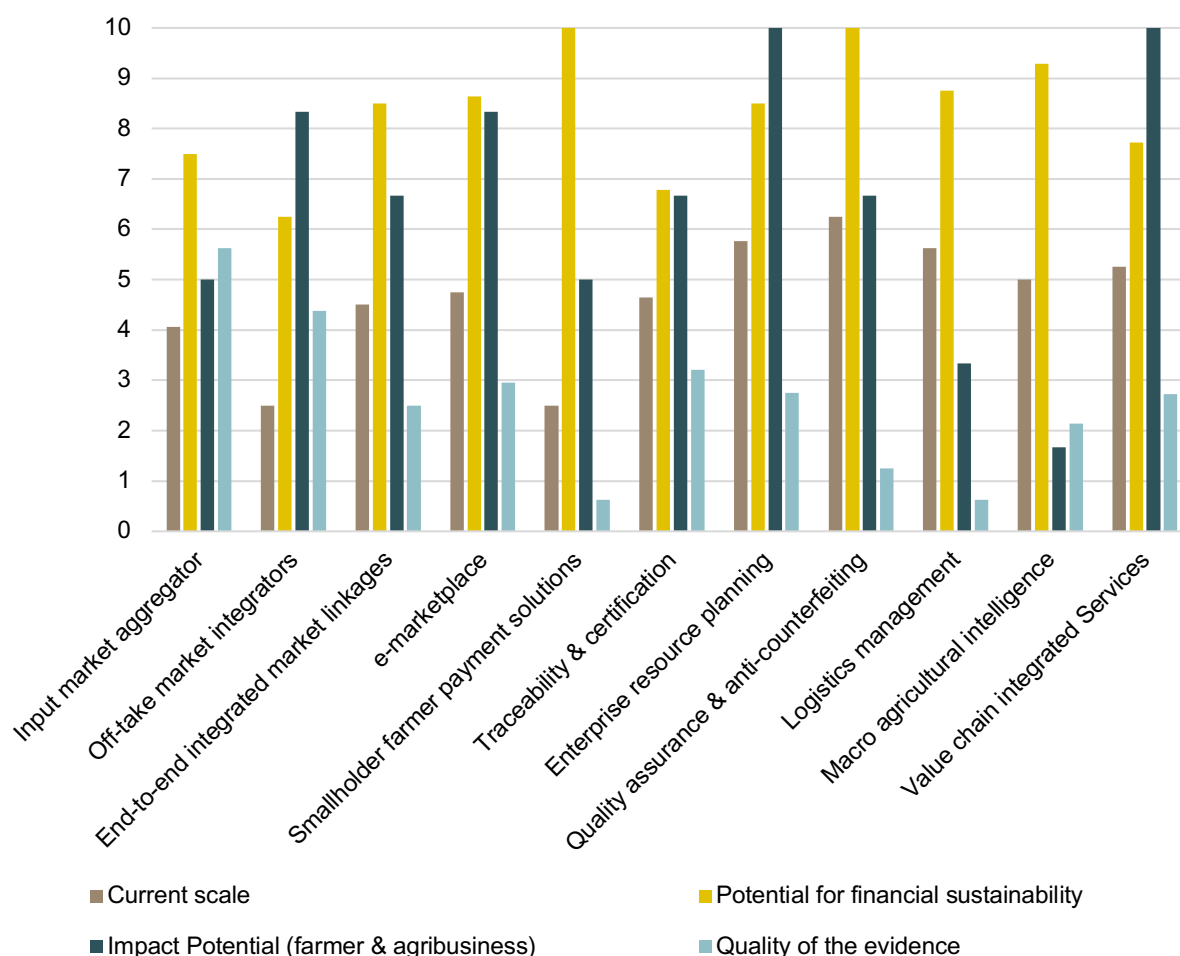
5. Success factors for effective deployment of mobile technologies

This section identifies those factors which appear to be prevalent across the successful application of mobile technologies to improve agribusiness productivity and investment readiness.

It is critical to differentiate successful business models for mobile-based agri-VAS, which can achieve both scale and financial sustainability, from successful impact models, which also need to pay attention to evaluation of that impact. The graph below shows how small-scale VAS can have great potential to achieve financial sustainability (e.g. smallholder payment solutions), while all larger-scale VAS also have high potential for financial sustainability. The graph shows a disconnect between the state of the evidence and the impact potential of the services. Some services have a relatively low potential impact at the agribusiness and farmer level (e.g. input market aggregators), but there is significant investment in evaluating the impact of these services. On the other hand, some VAS have great potential impact, but there has been almost no investment in evaluating this (e.g. enterprise resource planning and value-chain integrated services).

⁶ <https://www.casaprogramme.com/news-blogs/rethinking-agri-business-investments-through-the-pandemic-wrap-up-take-aways/>

Figure 3: Success potential and quality of evidence by service category



Service offering: impact potential

There is a broad range of mobile-based VAS that have been conceived with smallholder farmers in mind (e.g. advisory services) but not agribusinesses. Of the six main categories of agri-VAS, only five focus on SMEs. Of the 26 sub-categories of agri-VAS, only 14 target SME agribusinesses. In terms of volume, of the 175 agri-VAS covered in CTA's 2019 D4Ag report, only 75 were developed to target agribusinesses instead of just smallholder farmers. These services were initially conceived with a development mindset, but more recently they are being developed to address specific market constraints and in response to demand from value-chain stakeholders.

Addressing weak value-chain connections (agri-input – farmer – off-taker) and promoting value-chain efficiencies are the main motivations for 93.3% of the agri-VAS with SME agribusinesses as their main clients. This is the core functionality of the market linkage category and a critical sub-component of all the other VAS categories except macro agricultural intelligence (which are 6.7% of all the services).

Improving financial access is a key driver for agri-VAS with SME agribusinesses as their main clients, and it is usually a cross-cutting service instead of a service on its own, with the exception of smallholder payment solutions. Financial services, including payments, are embedded in 10 out of 11 categories of VAS (93.3% of the VAS) that have SME agribusinesses as their main client, the exception being the category of macro agricultural intelligence. The inclusion of financial services is critical for the business models of these VAS, particularly those that have smallholders as clients and rely on direct customer revenue, as financial services can facilitate the development of an additional income stream

(e.g. commission). However, this might not necessarily be the case for those services that rely on B2B revenue and want to maintain the service free of charge to the farmer.

The main motivation behind the development of advisory services is to improve agronomic practices to increase on-farm productivity, quality and profitability while reducing losses. This is one of the most popular types of mobile-based VAS that have smallholder farmers as their main clients. However, these are never standalone services when SME agribusinesses are the main clients. On the contrary, they are integrated with other VAS either to increase the impact and productivity of farmers, therefore helping increase the supply received by off-takers such as off-take market integrators, or to promote customer retention by agri-input dealers such as input-market integrators. For value-chain management and value-chain integrated services, advisory services are used to increase the supplier’s productivity and compliance with market requirements. Advisory services are embedded in nine out of the 11 VAS categories that have SME agribusinesses as their main clients (89.4% of the VAS). The exceptions are the categories of logistic management solutions and macro agricultural intelligence, which do not have smallholder farmers as clients.

Improving visibility and transparency throughout the value chain is the main driver for traceability and certification solutions (which account for 6.7% of the VAS). But it is also a key subservice for an additional 68.3% of VAS (75% in total), which are in the following categories: off-take market integrators; e-marketplaces; enterprise resource planning; digital quality assurance and anti-counterfeiting; macro agricultural intelligence; and value-chain integrated VAS.

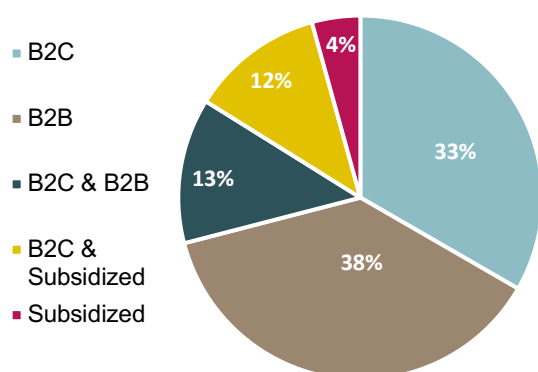
Improving the farm management of large numbers of smallholders is another key driver for these services. It is one of the key cornerstones of enterprise resource planning services (28% of VAS), and it is addressed through farmer supply aggregation by an additional 38% of VAS (off-take market integrators, end-to-end integrated market linkages, e-marketplaces and value-chain integrated services).

Improving business management capabilities is the main driver for enterprise resource planning services (which are 28% of VAS), as well as a key motivation for value-chain integrated services and some input market integrators (accounting for an additional 18% of the VAS). Together, these three categories include 47% of the VAS.

Both value-chain integral and enterprise resource planning VAS address all the top constraints faced by smallholder farmers and agribusinesses, as outlined above. They thus provide holistic solutions to the numerous problems faced by agricultural market systems.

Business model: financial sustainability, scalability and replicability potential

Figure 4: Percentage of VAS by revenue stream

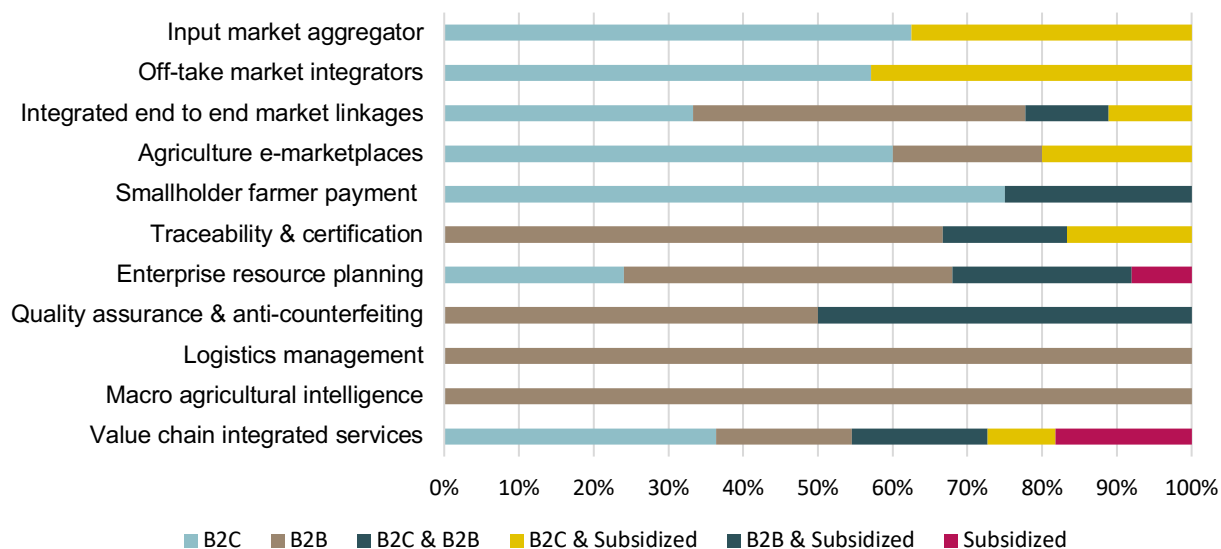


Of the VAS analysed in this study, 38% rely completely on B2B revenue; 33% rely on B2C revenue; and an additional 13% combine both B2C and B2B revenue streams for risk diversification. This means that 84% of all the VAS analysed in this study do not rely on subsidies. This scenario is fundamentally different from what can be seen in VAS that just have smallholders as clients and not agribusinesses (e.g. advisory services). Most of those services struggle to get enough direct customer revenue, as many farmers are unwilling to pay. That

makes it hard for them to break even, so they need subsidies to sustain their provision of services. Only 4% of the VAS analysed in this study rely fully on subsidies, most of which

are government extension programmes. Another 12% combine B2C and subsidies, highlighting the difficulty of relying only on direct customer revenue to support the services. This study found that none of the 104 VAS combined B2B revenues and subsidies, indicating that VAS that get B2B revenues are designed based on a latent demand from agribusinesses for the services offered.

Figure 5: Revenue stream distribution by service category



There are four VAS categories in which none of the services analysed rely on subsidies as an income stream: macro agricultural intelligence and logistics management, which fully rely on B2B revenue and are not targeted directly at smallholders; quality assurance and anti-counterfeiting, which obtains revenues from agri-input companies as well as farmers; and smallholder farmer payment solutions, which primarily relies on direct customer revenue through commissions. In both input market aggregators and off-take market integrators, none of the VAS rely on B2B revenue: these services are often developed with the goal of addressing farmers' needs instead of addressing a demand for services from agri-input dealers or off-takers. In contrast, the traceability and certification category responds to consumer demands: the appetite for paying for these services is mainly found at the agribusiness level and less at the smallholder level. Agriculture e-marketplaces either charge the sellers (farmers) or, in fewer cases, the buyers and vendors.

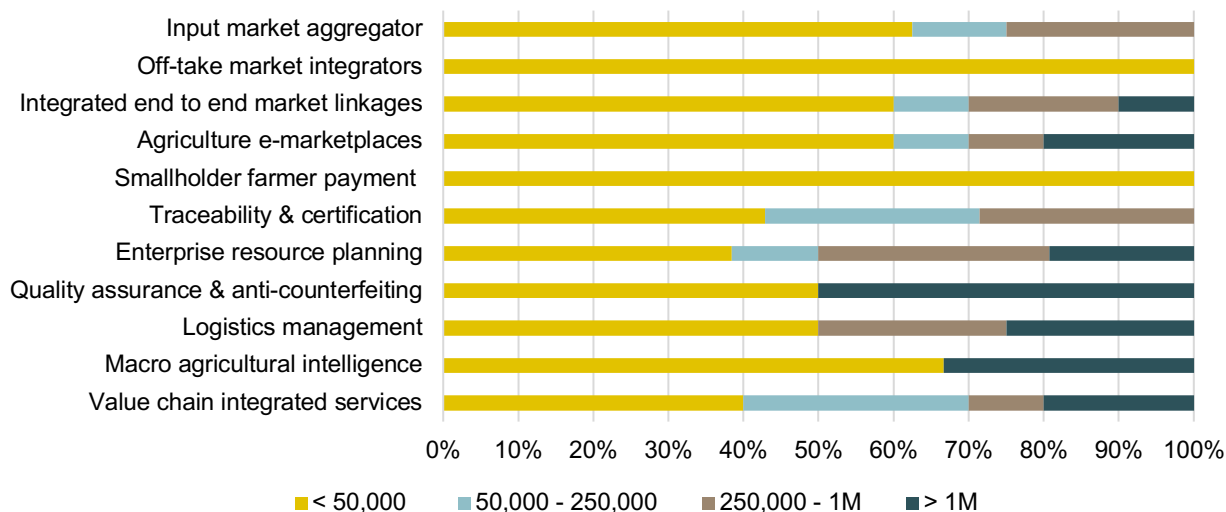
The remaining three VAS categories are arguably the most complex of the categories analysed in this study from a service-offering point of view. Each has a minimum of four revenue models, and they rely least on B2C revenue. Out of the three, value-chain integrated services relies least on B2B revenue (36% of the VAS) and it is one of the two categories with services that fully rely on subsidies. Around half of the VAS in the integrated end-to-end market linkages category rely on direct customer revenue and the other half on B2B. The number of enterprise resource planning VAS that rely on B2B exceeds the number relying on B2C, which makes it the biggest service category relying on B2B: 11 rely on B2B and six on both B2B and B2C.

The primary research highlighted that in order to become profitable, a VAS should have the following features. It needs to:

- be designed and tailored to meet an existing demand and willingness to pay, not aim to create a new demand
- have an adaptive pricing model in line with the service offering
- minimize the service's cost structure
- include financial services and mobile payments as an additional revenue stream

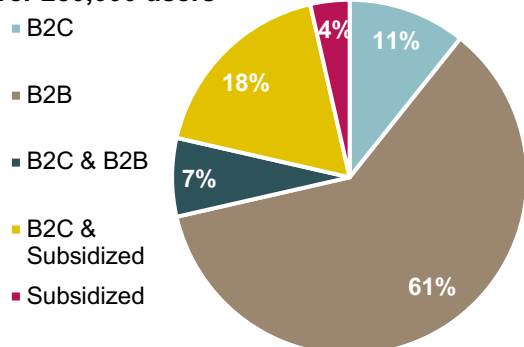
During the interviews, it was also mentioned that the ways in which agribusinesses engage with agri-VAS have a major impact on the type of underlying data (e.g. user profiles) gathered by the VAS provider and how it is used. This applies to value chains digitized by others (e.g. mobile network operators), solutions developed in-house (e.g. Olam or Cargill), B2B engagement through third-party VAS providers and partnerships to co-develop solutions. This area needs further research, as these modalities are a key to the investibility of a business model, and no secondary evidence is available. The value of data is also why large agribusinesses are trying to develop in-house services or get exclusive use over data generated through B2B service contracts.

Figure 6: Scale distribution by service category



Only fifty-five per cent of the VAS analysed in this study and none of the VAS in the off-take market integrators and smallholder farmer payment categories have more than 50,000 users. Twelve per cent of the services reach between 50,000 and 250,000 users and could be classified as services that are expanding. That means 66.5% of services reach fewer than 250,000 users, which this study considers to be a significant scale. This highlights significant difficulties for the majority of services to reach a meaningful scale. The biggest concentration of services with more than 250,000 users is in the enterprise resource planning category, where there are 13 of this scale (50% of the ERP VAS), of which five have more than 1 million users. The categories with the next highest numbers of VAS with over 250,000 users are value-chain integrated services, integrated end-to-end market linkages and agriculture e-marketplaces: all have three VAS with more than 250,000 users (approximately 30% of the VAS in each of the three categories). Categories having lower numbers of services with over 250,000 users but for which these services make up a higher percentage of the total in the category (two VAS, accounting for 50% of each category) are logistics management and quality assurance & counterfeiting.

Figure 7: Revenue streams for Agri-VAS with over 250,000 users



Of the VAS with more than 250,000 users, 61% rely on B2B revenue as their only income stream. An additional 7% combine B2B and B2C, so 68% of these services are of a significant scale. Only one of these VAS relies fully on subsidies to reach scale; it is a government-run service. Eleven per cent of the VAS rely on B2C as their only revenue channel, and the main income stream for all of these is commissions they charge on financial services they provide. This highlights farmers' higher willingness to pay for financial

services than for other types of service and the importance of financial services for reaching scale when relying only on direct customer revenue. Eighteen per cent of the VAS rely on a combination of B2C revenues and subsidies to reach scale, which indicates how challenging it is to make a profit and reach scale from only direct customer revenue.

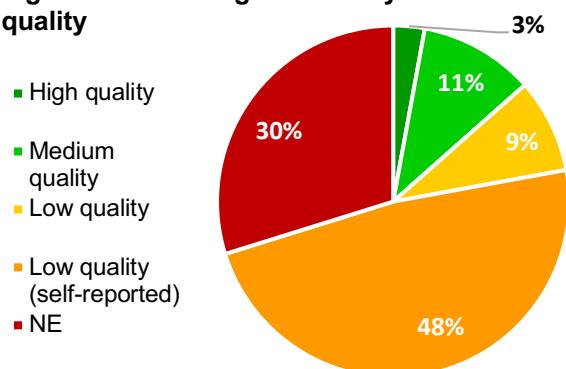
The primary research highlighted several characteristics of scalable VAS: They start with a clear demand for their services; they are flexible, adapt to different value chains and are easily integrated with other systems; they build on available technology and have a user-friendly interface; they are available in local languages to ensure customer retention and knowledge uptake; they have a private organization as the lead partner, or at least one of the key partners; they promote trust among stakeholders; and they keep investing to improve their offering, processes and technology and to increase staff numbers.

The concepts of financial sustainability and scale are often used together and occasionally in an interchangeable manner. However, VAS can reach substantial scale relying fully or partially on government or donor subsidies, which challenges their capacity to achieve financial sustainability in the longer term. On the other hand, services that are financially sustainable and rely on solid income streams are more likely to reach and maintain scale, as they are directly addressing an existing demand for a service for which there is enough willingness to pay.

The geographical footprint of a VAS is not directly related to the scale of the service or the nature of the enterprise running the service. For example, some fintechs reach more than 1 million users in just one country, while others need four countries to reach 250,000 users; and some social enterprises need two countries to reach 2 million, while a government organization can reach more than 12 million users in just one country. The primary research found that replicable VAS have the following characteristics: they are highly customizable and can be adapted to user needs, including value chains and local languages; they are easily integrated into other systems, such as banking; and they build on strategic partnerships for replication in other geographies.

State of the evidence

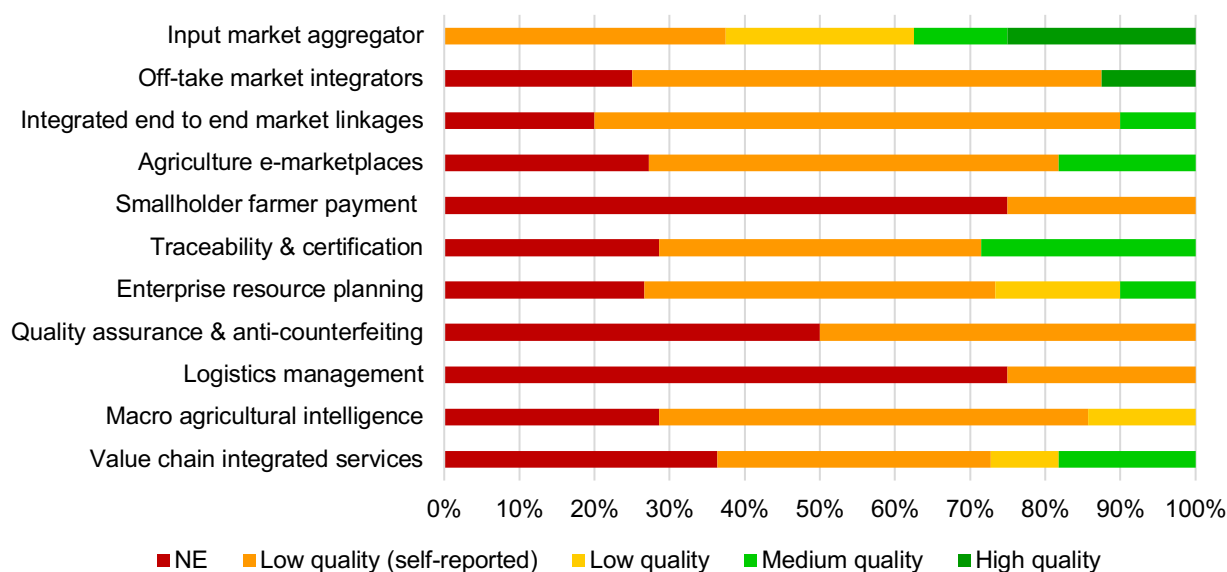
Figure 8: Percentage of VAS by evidence quality



Only 23% of the VAS have conducted some sort of evaluation of the impact of their services at either the smallholder-farmer or agribusiness levels. The majority of these evaluations focus on the impact at the farmer – and not the agribusiness – level. Three per cent of the services have conducted a rigorous analysis of their impact; 11% have conducted an evaluation that could be methodologically contested; and a further 9% of the services present some sort of evaluation of their impact through third-party

organizations without providing information about the methodology. Forty-eight per cent of the services report their impact themselves: in most cases this reflects their ambitions rather than an accurate representation of their actual impact, and it can thus be seen as a marketing strategy. And 30% of services do not provide any information about the impact they are having.

Figure 9: Evidence quality distribution by service category



There are three service categories for which no evaluation of the impact (at farmer and agribusiness levels) has been done: smallholder farmer payments; quality assurance & anti-counterfeiting; and logistics management. Only two categories have used a rigorous analysis to evaluate their impacts: input market aggregators and off-take market integrators.

For VAS with more than 250,000 users, the distribution of evidence is almost the same as for the totality of VAS covered in this study. However, the landscape changes for services with more than 250,000 users with revenue models based on B2B.

Figure 11: Evidence quality of VAS with more than 250,000 users

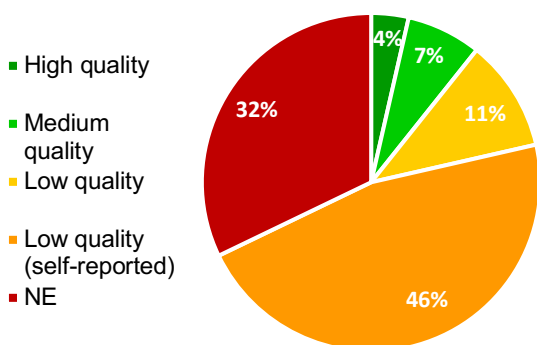
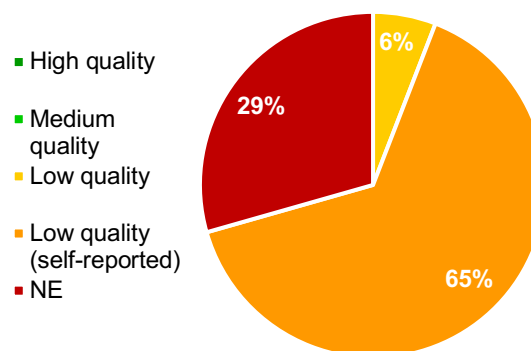


Figure 10: Evidence quality of VAS with more than 250,000 users and B2B revenues



None of these VAS have conducted any sort of rigorous analysis of their impact, and the proportion of VAS that self-report their impact is much higher, which can be seen as a marketing tool to attract more customers. It is also worth noting that if a service relies only on B2B revenue, the service was most likely developed in response to an existing business demand, and the scale achieved can be seen as a proxy for the service's success and impact.

Impact and investment opportunities

This section summarizes the impact data and analyses the potential investment opportunities and associated impacts either at the agribusiness level (agri-input or off-taker)

or in developing new VAS or expanding existing ones. The information is presented in the form of impact matrixes, one for each of the service categories analysed, as the impacts and investment opportunities differ according to the type of service. Cells shaded in grey are not impacted by investment either at the SME agribusiness or agri-VAS level.

Table 10: Investment opportunities and impact for input market aggregators




Input market aggregators			
Impact	Agri-input dealer 	Smallholder farmer 	Off-taker agribusiness 
Without investment in the agri-input dealer or VAS	Increased profits (improved customer outreach) Increased business management capacity and employability	Increased incomes (increased profits through reduced transaction costs, higher-quality inputs & yields)	NA
Investment in agribusiness connected to existing VAS	Increased potential for RoI (higher volumes of clients/farmers) Reduced investment risks (business management capacity)		
Investment to develop new VAS or expand existing one	Increased visibility over pipeline of investible agri-input dealers (higher profits and business management capacity)	Higher number of farmers with increased incomes	

Table 11: Investment opportunities and impact for off-take market integrators




Off-take market integrators			
Impact	Agri-input dealer 	Smallholder farmer 	Off-taker agribusiness 
Without investment in the agri-input dealer or VAS	NA	Increased incomes (higher profits through increased productivity, reduced losses and higher prices)	Increased profits (higher quantity and quality of supply & increased cost efficiencies) Increased transparency, accountability and traceability
Investment in agribusiness connected to existing VAS			Increased potential for RoI (higher quantity and quality of supply) Reduced investment risks (higher transparency)
Investment to develop new VAS or expand existing one		Higher number of farmers with increased incomes	Increased visibility over pipeline of investible agribusinesses (higher profits and improved transparency)

Table 12: Investment opportunities and impact for integrated end-to-end market linkages




Integrated end-to-end market linkages			
Impact	Agri-input dealer 	Smallholder farmer 	Off-taker agribusiness 
Without investment in the agri-input dealer or VAS	Increased incomes (increased sales)	Increased incomes (increased profits through increased yields and reduced losses)	Increased profits (higher quantity and quality of supply, and reduced farmer management costs)
Investment in agribusiness connected to existing VAS	Increased potential for RoI (higher volumes of clients/farmers)		Increased potential for RoI (higher quantity and quality of supply)
Investment to develop new VAS or expand existing one	Increased visibility over pipeline of investible agri-input dealers (higher profits)	Higher number of farmers with increased incomes	Increased visibility over pipeline of investible agribusinesses (higher profits)

Table 13: Investment opportunities and impact for agriculture e-marketplaces




Agriculture e-marketplaces			
Impact	Agri-input dealer 	Smallholder farmer 	Off-taker agribusiness 
Without investment in the agri-input dealer or VAS	Increased incomes (increased customer outreach)	Increased incomes (increased bargaining power and higher prices)	Increased profits (increased efficiencies and reduced costs) Reduced food waste and increased transparency
Investment in agribusiness connected to existing VAS	Increased potential for RoI (higher volumes of clients/farmers)		Increased potential for RoI (increased efficiencies) Reduced investment risks (higher transparency)
Investment to develop new VAS or expand existing one	NA	Higher number of farmers with increased incomes	NA

Table 14: Investment opportunities and impact for smallholder payment solutions




Smallholder farmer payment solutions			
Impact	Agri-input dealer 	Smallholder farmer 	Off-taker agribusiness 
Without investment in the agri-input dealer or VAS	Increased sales (payment on credit)	Reduced payment times for produce and increased incomes (improved productivity through advisory services)	Increased time efficiencies
Investment in agribusiness connected to existing VAS	Increased potential for RoI (higher volumes of sales)		
Investment to develop new VAS or expand existing one	Higher likelihood of RoI (high financial sustainability of VAS)	Higher number of farmers with increased incomes	Higher visibility of off-taker cash flows (reduced costs for assessing agribusiness investibility)

Table 15: Investment opportunities and impact for traceability and certification solutions




Traceability and certification solutions			
Impact	Agri-input dealer 	Smallholder farmer 	Off-taker agribusiness 
Without investment in the agri-input dealer or VAS		Improved productivity, quality and compliance. Reduced environmental footprint.	Increased transparency, compliance and brand image
Investment in agribusiness connected to existing VAS		Improved impact assessment	Reduced investment risks (higher transparency and compliance with international standards)
Investment to develop new VAS or expand existing one		Higher number of farmers with increased productivity and reduced environmental footprint	Increased visibility over pipeline of agribusinesses integrated in global value chains with standards

Table 16: Investment opportunities and impact for ERP







Enterprise resource planning			
Impact	Agri-input dealer 	Smallholder farmer 	Off-taker agribusiness 
Without investment in the agri-input dealer or VAS	Increased sales (increased customer outreach and efficiencies)	Increased incomes (increased productivity, GAP, produce quality, prices and reduced costs)	Improved SHF and SME management (reduced costs and increased efficiencies). Improved quantity, quality and compliance of produce
Investment in agribusiness connected to existing VAS	Increased potential for RoI (higher volumes of sales)	Improved financial access and impact assessment	Increased sales and transparency
Investment to develop new VAS or expand existing one	Increased visibility over pipeline of investible agri-input dealers (higher profits)	Higher number of farmers with increased incomes and access to finance Reduced cost of assessing impact of investment	Increased potential for RoI and reduced investment risks and costs (TA provision) Increased visibility over pipeline of investible agribusinesses (visibility over SME financial performance, farmer production and increased RoI – greater sales)

Table 17: Investment opportunities and impact for digital quality assurance and anti-counterfeiting

Digital quality assurance and anti-counterfeiting			
Impact	Agri-input dealer 	Smallholder farmer 	Off-taker agribusiness 
Without investment in the agri-input dealer or VAS	Increased customer loyalty Increased incomes (higher customer willingness to pay)	Increased productivity and incomes (improved input quality)	

Digital quality assurance and anti-counterfeiting			
Investment in agribusiness connected to existing VAS	Increased potential for Rol (higher customer retention and revenues)		
Investment to develop new VAS or expand existing one	Increased visibility over pipeline of investible agri-input dealers (higher profits)	Higher number of farmers with increased incomes	

Table 18: Investment opportunities and impact for logistic management solutions, storage and transport




Logistic management solutions, storage and transport			
Impact	Agri-input dealer 	Smallholder farmer 	Off-taker agribusiness 
Without investment in the agri-input dealer or VAS	Increased income (increased efficiencies and transparency)	Increased incomes Improved financial access	Increased sales, efficiencies and transparency Increased resilience against shocks (e.g. COVID-19)
Investment in agribusiness connected to existing VAS	Increased potential for Rol (higher volumes of sales)		Increased potential for Rol and reduced investment risks (including economic shocks like COVID-19)
Investment to develop new VAS or expand existing one	Increased visibility over pipeline of investible agri-input dealers (higher incomes)	Higher number of farmers with increased incomes and access to finance	Increased visibility over pipeline of investible agribusinesses (increased sales and resilience against shocks)

Table 19: Investment opportunities and impact for macro agricultural intelligence







Macro agricultural intelligence			
Impact	Agri-input dealer 	Smallholder farmer 	Off-taker agribusiness 
Without investment in the agri-input dealer or VAS	Increased customer outreach and efficiencies	Increased productivity and GAP. Reduced environmental footprint and climate risks	Improved efficiencies and reduced costs
Investment in agribusiness connected to existing VAS	Reduced investment risks (higher customer outreach)		Higher potential for Rol
Investment to develop new VAS or expand existing one		Higher number of farmers with increased incomes and access to finance	

Table 20: Investment opportunities and impact for value-chain integrated VAS

Value-chain Integrated VAS			
Impact	Agri-input dealer 	Smallholder farmer 	Off-taker agribusiness 
Without investment in the agri-input dealer or VAS	Increased income (increased customer outreach)	Increased incomes (increased productivity, GAP and reduced costs)	Improved SME management Improved quantity and reliability of supply Increased transparency
Investment in agribusiness connected to existing VAS	Increased potential for RoI (higher volumes of sales)	Improved financial access	Increased potential for RoI and reduced investment risks and costs (TA provision)
Investment to develop new VAS or expand existing one	Increased visibility over pipeline of investible agri-input dealers (higher profits)	Higher number of farmers with increased incomes and access to finance	Increased visibility over pipeline of investible agribusinesses (visibility over SME financial performance)

Investing in agribusinesses linked to an existing VAS can be perceived as a safety net to help reduce some of the investment risks and increase the potential for RoI, while ensuring the investment has a social impact. This is because these VAS often provide the kind of business management and agronomic technical assistance that investors seek, either to ensure the investibility of the agribusiness or to safeguard their investment.

Investing in a VAS directly can be safer than investing in an agribusiness. It can also offer additional benefits, such as increased visibility over the pipeline of investible agribusinesses. Given VAS' need for additional investment to continue increasing their service offerings and outreach, investing in VAS in the right service category and with the right business model should be seen as an opportunity. Demand for these services is expected to continue increasing, particularly in the wake of the COVID-19 pandemic.

Investing both in a VAS and the agribusinesses connected to it might help ensure full visibility of the performances of the investment and its competitors. It can present an opportunity for rapid tailoring of any support (technical assistance) needed to improve the performance or impact of an investee. However, investing like this would require either an expansion of investors' portfolios or collaboration among different types of investor, to ensure that those seeking impact can maximize their footprints, while those focused-on returns can reduce their risks.

The state of the evidence shows that VAS run by developmental organizations tend primarily to assess the impact of services at the farmer level, while a significantly smaller proportion do it at the agribusiness level. On the other hand, more-commercial stakeholders, which design services around an existing demand, tend to use their scale to understand the impact they are having at the agribusiness level: customer retention and acquisitions indicate that agribusinesses are seeing benefits from being linked to the VAS. If an impact-focused investor is investing in a service run by a private player, it could apply stricter requirements when evaluating the impact. This could help bridge the gaps between maximizing impact, sustainability and scale.

6. Recommendations

It is not easy to design and implement successful, scalable and sustainable agri-VAS business models that contribute to increasing agribusiness investment readiness, reduce investment risks and have a positive socio-economic and environmental impact at the farmer level. To achieve these developmental and profit goals, service providers, investors and

concessional finance providers need to understand the different types of VAS, service-design success factors and business model variations.

Agribusiness investibility and smallholder impact

When aiming to increase agribusiness investibility and smallholder farmer impact, it is of paramount importance to select the right service category. Value-chain integrated and enterprise resource planning services are the two categories that are best conceived to do the following: a) address weak value chain connections; b) improve financial access; c) improve agronomic practices; d) improve visibility and transparency throughout the value chain; e) improve farm management; and f) improve the management capabilities of agribusinesses. There is potential for further innovation in these two categories to ensure that services in the early stages of development achieve scale and their potential for impact.

Financial sustainability

The design of sub-service offerings is also 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 (B2C and B2B) 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). Service customization at the agribusiness level, including translation to local languages, is critical to increasing impact and willingness to pay. But it can delay the achievement of economies of scale, which can be a challenge when a service is relying only on grant funds.

The selection of revenue model should be aligned with the service offering and allow for adaptive pricing that considers service customization for clients' requirements. To reach financial sustainability, a VAS should avoid, wherever possible, relying on donor or government subsidies to develop its service. Subsidies are often seen as a potential catalyst for commercially viable services, but the role played and requirements set by the funder in the initial stages tend to skew the service design and development towards achieving developmental goals. It is more effective to start by addressing a market demand that can be capitalized on, something that is difficult to correct in the later stages of maturity. Services aiming for an impact on both the investibility of agribusinesses and the socio-economic empowerment of farmers should avoid just relying on B2C revenues. Such reliance would indicate that the service mainly has an impact at the farmer level and so might not reach sufficient scale. But if a service does rely on just B2C revenues, it should always include a financial service as part of its offering to increase the likelihood of achieving financial sustainability and scale.

Sustainable impact at scale

To be scalable, sustainable and impactful, a VAS should rely on B2B only, making the service free for farmers, or else combine B2B with B2C. It should also allow for an adaptive pricing model that fits the needs of clients. A critical factor in profit making is to minimize the cost structure of the VAS wherever possible, for example by reducing dependency on field agents, as these can become a bottleneck to achieving scale and replication. It is also necessary to determine who owns the customer data in various models when considering support or investment.

Scale does not depend on the financial sustainability of the service, as government-led agri-VAS can reach great scale. But profit-making VAS that rely on solid income streams are more likely to reach and maintain scale (i.e. retain customers), as they are more likely to be addressing an existing demand service for which there is enough willingness to pay. Apart

from the revenue model, to be scalable and replicable a service provider needs to: a) develop a flexible and adaptable VAS to different value chains, languages and client requirements; b) build on available technology and focus on user-friendliness; c) promote trust among stakeholders linked to the VAS; d) keep investing to improve the service offering, processes, technology and staff capacity; and e) build on strategic partnerships for replication in other geographies.

Body of evidence

Significant investments are needed to improve the quantity and quality of evidence evaluating the impact of VAS at the agribusiness and farmer levels. Donors and impact investors should play a role in supporting the service-offering development and geographical expansion of successful (that is, scalable and financially viable) agri-VAS with SME agribusinesses as their main clients. These are usually the services that invest the least in rigorous assessments of their impact. Direct grants or concessional loans should concentrate on improving impact evaluations (scaled in methodology to match the service being evaluated), both at the agribusiness and farmer levels. Better evidence would also help increase the pipeline of investible agribusinesses, as more agribusinesses would see the benefits of being connected to the VAS. Moreover, it would increase the developmental impact at scale of services that are already sustainable. However, the complexity of digital technology and the speed at which its landscape changes mean that donor organizations and impact investors require a high degree of technical skill to understand and select which agri-VAS services to support.

Investment opportunities

There is a latent demand for additional investment in both agri-VAS providers and agribusinesses linked to agri-VAS. Investors should consider investing in agribusinesses linked to an existing VAS, as this can help reduce some of the investment risks thanks to higher transparency and increased compliance with international standards. Existing VAS can also have greater potential for RoI combined with a social impact. But the exact impact and reduction in investment risk will depend on the specific service category. Investors could consider investing in a VAS itself, as that can be safer than investing at the agribusiness level and can also offer additional benefits, such as greater visibility over the pipeline of investible agribusinesses. Investing both in the VAS and the agribusinesses connected to it can help ensure full visibility of the performances of the agribusiness and its competitors. It can also present an opportunity for rapid tailoring of any kind of support (technical assistance) needed to improve the performance or impact of an investment.

COVID-19

COVID-19 is, without any doubt, one of the most disruptive events to have hit global food and market systems in the 21st century. Lockdowns and travel restrictions imposed by governments have resulted in a surge in demand for agri-VAS to cope with some of the constraints emerging from the pandemic (e.g. access to inputs, finance and markets). The pandemic therefore presents an opportunity for both impact and commercial investors to support the scaling up (customer base, geographical footprint and service diversification) of successful and impactful mobile-based agri-VAS. The increased demand, which is projected to continue in the medium and long term, should be seen as a boost for the achievement of RoI as well as impact. Concessional finance providers could potentially focus on supporting the cashflows of affected agribusinesses linked to successful agri-VAS. Such support would accelerate the reactivation of the market and reduce the negative impact of the pandemic, while capitalizing on agri-VAS to overcome some pandemic-related constraints. Additional research will also be needed to better understand the impact of COVID-19 on service demand for each of the agri-VAS categories, as well as the potential of some of these services to address pandemic-related challenges.

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Annex 1 – Landscape Analysis

Mapping agri-VAS with SME agribusinesses as their main clients

Correctly categorizing ICT agri-VAS is becoming more complex and dynamic, as service providers tend to bundle different offerings under a single umbrella. Bundling services together has proven to be one of the most successful strategies to achieve financial sustainability and impact at the user level. This means that a traditional advisory and information VAS can easily evolve into a market linkage VAS and quickly adopt the functionalities of enterprise resource planning, changing its categorization to a supply chain management VAS. The categorization of VAS done here might differ from that in previous analyses (e.g. CTA: 2019), as this study aims to analyse the complete service offerings of VAS instead of breaking them down into categories based on the individual services they provide. This way of categorizing VAS contributes to a better-informed analysis of the full potential of each VAS to achieve sustainability and impact.

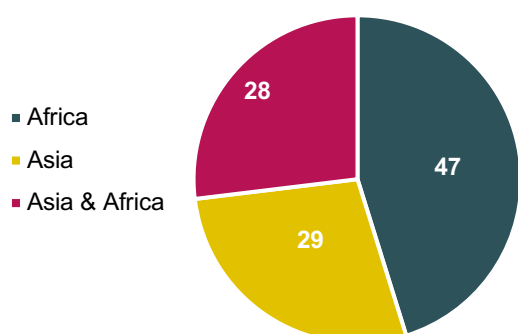
Table A21: Agri-VAS for SME agribusinesses across sub-Saharan Africa and South Asia⁷

VAS Category	VAS Sub-category	Sub-Saharan Africa	South Asia
B. Market linkages	a. Input market aggregator	1 DigiShop; 3 Babban Gona; 4 DigiFarm; 5 iProcure; 6 myAgro; 8 CowTribe 2 One Acre Fund	7 Tun Yat
	b. Off-take market integrators	9 Farmshine; 10 Selina Wamucii; 11 Taimba; 13 Soko Yetu; 15 Trade	12 FarmerLink; 14 LOOP; 16 Umá iFarms
	c. End-to-end integrated market linkages	17 Tulaa; 19 Mobigrow	18 Agribuddy; 20 Ricult; 21 Golden Paddy; 22 My Smartfarm; 23 Talad; 24 CROWDE; 25 HwetToe; 26 SIPINDO
	d. e-marketplace	27 TruTrade; 29 AgroMarketDay; 30 LimaLinks; 31 CropChain; 32 FarMall; 33 Rubi; 34 Zowasel 28 MasterCard's Farmers Network; 37 Farmster	35 e-Nam; 36 RegoPantes
C. Financial access	a. Smallholder farmer payment solutions	38 Agri-Wallet	39 SLIDE; 40 Cropital; 41 Tanijoy
D. Supply chain management	a. Traceability & certification solutions	46 NamLITS 42 Source Map; 43 Chain Point; 45 Sustainable Coffee Verification; 48 BlockChainForGood	44 Bluenumber; 47 GeoTraceability
	b. Enterprise resource planning	50 Connected Farmer; 51 eProd; 57 Rural Sourcing Management; 58 SmartCow; 59 myFugo; 60 DigiCow; 61 Akokotakra; 62 EzyAgric; 65 Metajua; 67 SNS; 68 Sen Ngunu; 69 AgriGo; 73 Probita Farms; 74 Budget Mkononi; 75 Agropay 49 OFIS; 53 Agreo; 54 Farmforce; 55 CropIn; 56 SourceTrace; 66 TaroWorks; 70 Agrivi; 71 Agrio; 72 Food Trust; 78 Cadasta Platform	52 FarmCloud; 63 SimpleAgri; 64 Farm ERP; 76 Connected Crop Solution; 77 neolnt
	c. Quality assurance & anti-counterfeiting	79 QualiTrace 80 ScanTrust; 81 Sproxil; 82 mPedigree	
	d. Logistics management	83 Virtual City; 85 iProcure; 86 Weight Capture 84 Logistimo	
	E. Macro agricultural intelligence	90 6 th Grain 87 Gro Intelligence; 91 ACRE; 92 Next Billion Agri Marketplace; 93 Akyo Flow & Lumen	88 Advance AI driven analysis; 89 HARA Token
F. Value-chain integrated services	94 Farm to Market Alliance; 95 ATA Ethiopia; 96 Agrikore; 98 Farmerline; 104 EcoFarmer 97 Rural Taobao; 99 N-Frnds; 100 AgUnity	101 MyCrop; 102 ListenField; 103 Eragano	

⁷ The numbering in the table correlates with the order in which each agri-VAS appears in subsequent sections

Geographical location of agri-VAS analysed

Figure A12: Agri-VAS geographical



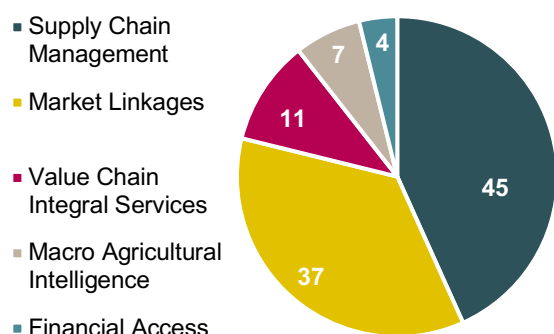
This study conducted a comprehensive review of existing agri-VAS that have SME agribusinesses as their main clients. Out of the 104 services identified, 75 are present in at least one African country. Out of those, 47 have a presence only in Africa. Fifty-seven of the services are present in at least one Asian country, and 29 of these have a presence only in Asia. This indicates that, although a great proportion of the innovation in the field is happening in Africa, the number of services expanding across continents is increasing.

This geographical distribution of VAS differs according to the category and sub-category of the specific service. For example, six out of the eight

input market aggregators only have a geographical footprint in Africa; eight out of the 10 end-to-end integrated market linkages only have a presence in Asia; all of the logistics management services have a presence in Africa, and only one is also present in Asia. This means that the geographical proliferation of these types of services depends on the specific challenges (e.g. lack of infrastructure) and opportunities (e.g. better-integrated value chains) faced in each of the two regions.

Proportion of agri-VAS by category

Figure A13: Agri-VAS proportion by category



Of the 104 agri-VAS that have SME agribusinesses as their main clients, 45 can be classified as supply chain management services. Within that category, 30 are enterprise resource planning VAS, which is the biggest sub-category of services in this study, accounting for almost one-third of the agri-VAS that have SME agribusinesses as their main clients. These services were conceived to address some of the most pressing challenges faced by SME agribusinesses – limited management capacity and the digitalization of farm management processes.

The second biggest category of services is market linkages (37 out of 104 VAS), which is divided roughly equally between input market aggregators (eight), off-take market integrators (eight), end-to-end integrated market linkages (10) and e-marketplaces (11). This indicates that the second biggest motivation for developing agri-VAS that have SME agribusinesses as their main clients is the need for greater connections and integration within value chains, to increase efficiency, reduce costs and widen customer outreach. Value-chain integrated services form a fairly new category of services, which has been increasing rapidly: it includes 11 out of the 104 services identified and bundles supply chain management and market linkages with macro agricultural intelligence and financial services.

Analysis of the evidence base

The following analysis is based on publicly available information and it is divided for each service category into - service offering; business model; impact; and selection of VAS for primary research.

Market Linkages

Services within this category use digital tools to facilitate connections across different levels of the value chain. These connections lead to transactions of goods or services between value chain actors including smallholder farmers; farm aggregators such as cooperatives, agro-input producers or intermediaries; farmer services providers (e.g. agronomists, mechanization or financial institutions); produce buyers, traders, and processors; and international exporters, domestic wholesalers and retailers of finished food products.

Input Market Aggregators

This category includes ICT enabled VAS that connect farmers with high quality inputs and dealers, and aims to reduce transaction costs while promoting efficiencies for both parties. This study classifies 8 of the 104 VAS as Market Input Integrators.

Table A22: Input market aggregators – service offering

Name	Service offering						
	Agro-input information & connection	Agro-input SME mgmt	Agro-input SME capacity building	Financial services for agro-input SME	Financial services for farmers	Farmer advisory services	Market facilitation for farmers
DigiShop ⁱ	•		•	•	•	•	
One Acre Fund ⁱⁱ	•				•	•	•
Babban Gona ⁱⁱⁱ	•				•	•	•
DigiFarm ^{iv}	•				•	•	•
iProcure ^v	•	•			•		•
myAgro ^{vi}	•				•	•	
Tun Yat ^{vii}	•				•		
CowTribe ^{viii}	•					•	

The connection between farmers and agro-input dealers is often accompanied by agronomic and input advice for farmers, which helps ensure that farmers are able to fully capitalize on the use of high-quality inputs to improve the quality and quantity of their produce. These post-sales services contribute to increasing customer perception of benefits, as well as to promoting customer retention. Financial services are often combined with these VAS to help farmers cope with the premium price of high-quality inputs, and to develop an additional revenue stream (through commission) to sustain the service.

Table A23: Input market aggregators – business model

Name	Location	Business model					
		Nature enterprise	Revenue model	Maturity stage	Delivery channel	Customers	Number of users
DigiShop	Kenya	Social Enterprise (Farmers Pride)	B2C (commission 10-15%)	Start-up	App, Web Franchised dealers	SHFs Agro-input dealers	>10,000 farmers
One Acre Fund	Africa (9) Asia (1) ⁸	Non-for profit	B2C (loan commission 70%) & Subsidized (30%)	Maturity	SMS F2F	SHFs Coops	>800,000 farmers
Babban Gona	Nigeria	Social Enterprise (Investor-owned)	B2C (commission) & Subsidized (Global Innovation Fund, FMO & AgriFI)	Growth	App, Web F2F	SHFs Farmers' groups Field officers	1,000 farmers to date >37,000 farmers 2020 season
DigiFarm	Kenya	MNO (Safaricom)	B2C (commission)	Maturity	USSD	SHFs Farmers' groups	>1 M farmers (300,000 active) -144 vendors
iProcure	Kenya	Venture Capital Novastar Ventures Ltd.	B2C (90% input sales, 10% warehouse mgmt.)	Growth	App Web	SHFs Coops Agro-input dealers Wholesalers Depots	>1,500 vendors
myAgro	Africa (3) ⁹	Social Enterprise & NGOs	B2C (commission) & subsidies	Expansion	SMS, App Village entrep.	SHFs Agro-input dealers	>70,000 (60% women) >800 vendors
Tun Yat	Myanmar	Private AgTech	B2C	Start-up	App	Machine suppliers SHFs	>4,000 farmers

⁸ Burundi, Kenya, Malawi, Rwanda, Tanzania, Uganda, Nigeria, Zambia, Ethiopia & India

⁹ Tanzania, Senegal, Mali

Name	Location	Business model					
		Nature enterprise	Revenue model	Maturity stage	Delivery channel	Customers	Number of users
CowTribe	Ghana	Tech company	B2C (subscription fees)	Start-up	App Web SMS	SHFs Vets	>30,000 farmers

All of the Input Market Integrators rely either completely or partially on direct customer revenue, and at least 50% of them apply a commission to the financial services provided. Four of these Agri-VAS reach more than 50,000 clients, and 3 of them rely on commissions as key revenue stream.

Table A24: Input market aggregators – impact

Name	Evidence Quality	Impact	
		Agro-input dealer	Farmer
DigiShop		Improved customer outreach Improved business management capacity Increased access to finance	Improved access to high quality inputs
One Acre Fund	¹⁰	Increased employability (8,280 jobs created)	Increased farmer income (\$96 annually) Increased farmer knowledge and improved practices
Babban Gona	¹¹	NE	Increased productivity (doubled yields) Increased net income (3.5 times) Increased food security
DigiFarm		NE	Improved access to high quality inputs Increased farm productivity Increased access to finance
iProcure		Higher profit margins (manufacturer discounts)	Improved access to high quality inputs Reduced cost of inputs
myAgro	¹²	Increased incomes due to service commission (\$35 to \$50)	Improved access to high quality inputs Increased productivity (50%-100%) Increased income (\$150-\$300)
Tun Yat		Increased employability (72 jobs created in renting machinery)	Reduced cost of inputs (\$43 per farmer)
CowTribe	¹³	NE	Improved vaccine coverage (18% - 65%) Lower livestock mortality rates (<5%) Increased farmer income (\$300 annually)

The main takeaways from the state of the evidence on the impact of Input Market Integrators is that less than 40% of the VAS within this category have conducted any sort of rigorous impact evaluation of their service. These VAS tend to be run by either not-for-profits or social enterprises and all of them are partially subsidized by donor funding, which indicates that proving positive developmental impact is one of the main motivations for the service provision and for donor accountability purposes. Looking beyond the quality of the analysis, only 60% of the VAS report both the impact at the farmer and the agro-input levels, while the remaining 40% only focus on the impact at the farmer level. The main impact reported at the agro-input level is related to increased income and marketing.

Table A25: Input market aggregators – ranking

Name	Ranking						
	Service offering	Potential for financial sustainability	Current scale	Impact on agribusiness investibility	Quality of the evidence	Total score	Ranking within category
DigiShop	1.4	2	1	2	0.5	6.9	2
One Acre Fund	1.1	0	2	1	2	6.1	4
Babban Gona	1.1	1	2	1	2	7.1	1
DigiFarm	1.1	2	2	1	1	7.1	1
iProcure	1.1	2	0	1	0.5	4.6	6

¹⁰ (One Acre Fund, 2020)

¹¹ (Global Innovation Fund, 2018)

¹² (myAgro, 2019)

¹³ (MaMo, 2019)

Name	Ranking						
	Service offering	Potential for financial sustainability	Current scale	Impact on agribusiness investibility	Quality of the evidence	Total score	Ranking within category
myAgro	0.9	1	2	1	1.5	6.4	3
Tun Yat	0.6	2	0	1	0.5	4.1	7
CowTribe	0.6	2	1	1	1	5.6	5

Off-take Market Integrators

This category includes ICT enabled VAS that connect farmers with off-takers and dealers, and aims to reduce transaction costs while promoting efficiencies for both parties. This study classifies 8 of the 104 VAS as Off-take Market Integrators.

Table A26: Off-take market integrators – service offering

Name	Service offering						
	Farmer registration	Advisory services	Farmer supply aggregation	Financial Services	Connection to national vendors	Connection to intl. vendors	Traceability
Farmshine ^x	•	•	•	•	•	•	•
Selina Wamucii ^x	•	•	•	•	•	•	
Taimba ^{xi}	•	•	•		•		•
FarmerLink ^{xii}	•	•		•	•	•	
Soko Yetu ^{xiii}	•		•	•	•		
LOOP ^{xiv}	•		•	•	•		
Trade ^{xv}	•		•		•		
Umá iFarms ^{xvi}		•		•	•		

The connection between farmers and off-takers always offers connections to national and in some cases international vendors, which helps reduce the number of intermediaries between the farmer and the buyer. Farmer supply aggregation is in most of the cases one of the key functionalities of the VAS, reducing the transaction costs of aggregating high-quality produce from highly fragmented smallholder value chains. Financial and advisory services are often bundled too, contributing to adding value to farmers due to improved productivity and certainty of market access.

Table A27: Off-take market integrators – business model

Name	Location	Business model					
		Nature enterprise	Revenue model	Maturity stage	Delivery channel	Customers	Number of users
Farmshine	Kenya ¹⁴	Social enterprise	B2C (commission)	Growth	F2F App	SHFs Farmers groups	>8,000 farmers (70% women) 20 field agents
Selina Wamucii	Africa (6) ¹⁵	Social enterprise	B2C (mark-up)	Growth	Web USSD	Coops Farmers groups Exporters Processors	>7,000 farmers
Taimba	Kenya	Pvt. company TechnoServe (farmer outreach)	B2C (commission)	Growth	SMS Whatsapp Web	Cooperatives Farmers groups Retail vendors	>2,000 farmers >15 coops >350 vendors

¹⁴ Malawi planned for the second half of 2020

¹⁵ Kenya, Ethiopia, Uganda, Tanzania, Rwanda, Mozambique, Madagascar

Name	Location	Business model					
		Nature enterprise	Revenue model	Maturity stage	Delivery channel	Customers	Number of users
FarmerLink	Philippines	Not for profit Social Enterprise, Not for profit (Grameen Foundation)	B2C (commission)	Mature	SMS, Alerts Extension Community Agents	Wholesalers/Retailers Lenders Governments	>27,500 farmers
Soko Yetu	Kenya & West Africa ¹⁶	Pvt. company (Twiga Foods), MNO (Safaricom)	B2C (mark-up) & Subsidized	Growth	F2F, App M-Pesa	SHFs Vendors	17,000 farmers 8,000 vendors
LOOP	India	Not for profit (Digital Green)	B2C (commission) & Subsidized	Growth	F2F, App Helpline SMS	SHFs Transporters Vendors	>3,000 farmers
Trade	Ghana	Pvt, company	B2C (commission) & Subsidized	Start-up	App, IVR F2F	SHFs Transporters Vendors	>4,800 farmers 250 vendors
Umá iFarms	Philippines	Pvt. company iFarms Inc.	NE	Start-up	Web App	SHFs Coops	NE

All of the Off-take Market Integrators rely either completely or partially on direct customer revenue, 60% of them apply a commission, and the 3 services that depend partially on donor funding are those that bundle the least amount of sub-services (4 out of 7 or less). This indicates that the higher the amount of sub-services bundled, the higher the likelihood to reduce the dependency on subsidies. Only one of these VAS reaches more than 50,000 clients, and relies on commissions as its unique revenue stream. Fifty percent of these services are being deployed in Kenya.

Table A28: Off-take market integrators – impact

Name	Evidence Quality	Impact	
		Farmer	Off-taker / lead firm
Farmshine		Increased productivity Increased farmer incomes	NE
Selina Wamucii		Increased productivity & harvest quality Improved payment transparency Increased farmer incomes (higher prices) Improved climate change adaptation	Increased quantity and quality of supply Digitized traceability Improved market insights
Taimba		Reduced demand fluctuations Reduced post-harvest losses (50%) Increased incomes (higher prices; 20%-30%)	Reduced supply costs (\$2- \$3 per transaction) Improved time efficiency (3-4 hours) Higher supply quality
FarmerLink	¹⁷	Increased adoption of GAP Improved climate resilience Reduced crop losses Increased productivity	Improved time efficiency Increased efficiencies and reduced costs
Soko Yetu		Improved market access Increased pricing transparency Increased access to advice on GAP Increased financial access	Increased quality of supply Increased profits through improved prices and reduced costs Assured food safety through tracking Increased access to finance Reduction in supply chain waste (40%)
LOOP		Improved market access Increased revenues (higher prices) Increased farmer incomes (50%)	Increased operational transparency Minimized risk of fraud Increased accountability
Trade		NE	NE
Umá iFarms		NE	NE

The main takeaways from the state of the evidence on the impact of Off-take Market Integrators is that only one of the VAS within this category has conducted any sort of rigorous impact evaluation of their service. This VAS (FarmerLink) is run by a not-for-profit social enterprise (Grameen Foundation), which indicates that proving positive developmental impact is one of the main motivations for the service provision. Independently from the quality of the analysis, only 60% of the VAS report both the impact at the farmer and the off-taker levels. The main impacts reported at the off-taker level are

¹⁶ Projected

¹⁷ (Herrera et al., 2019)

related to economic benefits and to some extent reduced investment risks: increased cost efficiencies and time savings; higher supply quality; improved market insights; increased transparency, accountability and traceability.

Table A29: Off-take market integrators – ranking

Name	Ranking						
	Service offering	Potential for financial sustainability	Current scale	Impact on agribusiness investibility	Quality of the evidence	Total score	Ranking within category
Farmshine	2	2	1	1	1	7	2
Selina Wamucii	1.7	2	1	2	1	7.7	1
Taimba	1.4	2	0	1	1	5.4	5
FarmerLink	1.4	1	1	1	2	6.4	3
Soko Yetu	1.1	1	1	2	1	6.1	4
LOOP	1.1	0	0	1	1	3.1	6
Trade	0.9	1	0	0	0	1.9	7
Umá iFarms	0.9	1	0	0	0	1.9	8

Integrated End to End Market Linkages

This category includes ICT enabled VAS that connect farmers with both agro-input dealers and off-takers, and aims to capture value while generating impact for both smallholder farmers and agribusinesses by formalizing currently fragmented and informal value chains. These VAS can also help improve transparency and trust, reduce costs, accelerate time to market, as well as growing the reach, social impact, and profitability of traditional value chain linkage models. This study classifies 10 of the 104 VAS as Integrated end to end market linkages.

Table A30: Integrated end-to-end market linkages – service offering

Name	Service offering							
	Access to agro inputs	Access to machinery / labourers	Link to mechanic services	Advisory services	Financial services	Farmer supply aggregation	Contract mgmt.	Market access
Tulaa ^{xxvii}	•			•	•	•	•	•
Agribuddy ^{xxviii}	•	•		•	•	•		•
Mobigrow ^{xxix}	•			•	•	•		•
Ricult ^{xxx}	•			•	•	•		•
Golden Paddy ^{xxxi}	•			•	•			•
mySmartfarm ^{xxxii}	•			•	•			•
Talad ^{xxxiii}		•	•	•				•
CROWDE ^{xxxiv}	•			•	•			•
HtwetToe ^{xxxv}	•			•				•
SIPINDO ^{xxxvi}	•			•				•

The key characteristic of these VAS is that all of them offer at least 3 sub-services - access to inputs (both agro inputs and machinery), market access and advisory services, which helps ensure integration of farmers within value chain while promoting compliance. Financial services are often bundled too, contributing to reducing costs and time while increasing accountability and offering an additional revenue stream.

Table A31: Integrated end-to-end market linkages – business model

Name	Location	Business model					
		Nature enterprise	Revenue model	Maturity stage	Delivery channel	Customers	Number of users
Tulaa	Kenya	Fintech company (spin-off from Esoko)	B2C (mark-up & commission)	Start-up	– SMS – App	– Agro-input dealers – SHFs – Aggregators – Transporters – Vendors	>100 agro-input dealers >27,000 farmers
Agribuddy	Asia (3) ¹⁸	Private company (Agribuddy Ltd.)	B2C (commission)	Start-up	– App – Web – Face to face	– Field agents (buddies) – SHFs – Farmers groups	>47,000 farmers
Mobigrow	East Africa (2) ¹⁹	Bank (Kenya Commenrcial Bank) & MasterCard Foundation	B2C (processing fee) & subsidized	Expansion	– Face to face – USSD – SMS	– SHFs – Farmer's groups – Coops – Agribusinesses	>400,000 farmers >225 coops
Ricult	Asia (2) ²⁰	AgTech Social Enterprise	B2B & free for farmers	Start-up	– App – SMS – Voice call	– Agro input dealers – Agribusinesses – Banks	>10,000 farmers
Golden Paddy	Asia (2) ²¹	Social enterprise (Impact Terra)	B2B (selling farmer data & commission to input dealers) free of charge for farmers	Growth	– App – Web – Facebook	– SHFs – Labourers – Agro inputs – Agribusinesses – Vendors	>2.8M farmers
mySmartfarm	Vietnam & Philippines	Private company Smartfarms Network Pte Ltd	B2B (corporate subscriptions) B2C (commission)	Pilot	– App – Web	– SHFs – Farmers groups – Agro-input dealers – Agribusinesses	>100 farmers
Talad	Thailand	Private company Talad Holding Corp. Ltd	Free of charge for users	Start-up	– App	– SHFs – Labourers – Agro inputs – Vendors – Mechanics	>80,000 farmers
CROWDE	Indonesia	Private company AgTech and Fintech	B2C	Start-up	– Web – App	– Agro input dealers – Agribusinesses – Investors – Lenders	>14,000 farmers
Htwet Toe	Myanmar	Private AgTech company	B2B & free for farmers	Growth	– Web – App	– SHFs – Agro input dealers – Agribusinesses – Vendors	>300,000 farmers
SIPINDO	Indonesia	East West Seed	B2B (business intelligence info) & free for farmers	Growth	– App – Web – USSD	– SHFs – Farmer's groups – Coops – Agribusinesses – Buyers	>20,000 farmers

Half of the Integrated end to end market linkages VAS rely partially or fully on direct B2B revenue and the other half on B2C revenue and only one of the services depend on subsidies as an income stream. All of the services are privately owned, which indicates the importance paid to achieving financial sustainability. Forty percent of the VAS reach over 50,000 farmers and 20% over 40,000 farmers. These factors highlight that integration of value chain stakeholders offers greater likelihood of achieving financial sustainability and scale.

¹⁸ Cambodia, Bangladesh & India

¹⁹ Kenya and Rwanda

²⁰ Thailand, Pakistan

²¹ Myanmar, Vietnam

Table A32: Integrated end-to-end market linkages – Impact

Name	Evidence Quality	Impact		
		Agro-input dealer	Farmer	Off-taker / lead firm
Tulaa	22	<ul style="list-style-type: none"> – Increased input sales – Increased incomes 	<ul style="list-style-type: none"> – Increased harvest quality – Increased revenues (higher prices) – Reduced post-harvest losses – Increased income (165%) 	<ul style="list-style-type: none"> – Increased sourcing from farmers with higher yields – Reduced farmer management costs – Reduced transport costs – Increased incomes
Agribuddy		NE	– Increased income	NE
Mobigrow		NE	<ul style="list-style-type: none"> – Increased financial inclusion and liquidity – Increased productivity 	NE
Ricult		NE	<ul style="list-style-type: none"> – Increased productivity – Reduced input use and costs – Increased income (30%) 	NE
Golden Paddy		NE	– Improved agricultural practices	NE
mySmartfarm		– Lower costs (distribution)	<ul style="list-style-type: none"> – Increased farm productivity – Increased revenues (higher prices) – Lower input costs 	– Improved access to predictive performance data
Talad		NE	<ul style="list-style-type: none"> – Increased productivity – Increased market access 	NE
CROWDE		NE	<ul style="list-style-type: none"> – Increased financial inclusion – Increased income 	NE
Htwet Toe		NE	NE	NE
SIPINDO		NE	NE	NE

The main takeaways from the state of the evidence on the impact of Integrated end to end market linkages is that only one of the VAS within this category has conducted any sort of rigorous impact evaluation of their service. Only 20% of the VAS in this category report the impact of the VAS at the agro-input dealer, off-taker and farmer levels. The remaining services either only report the impact at the farmer level or the evidence is lacking. The main impacts reported at the off-taker and agro-input dealer levels are related to economic benefits (e.g. increased incomes and reduced management costs), while reduced investment risks only come across in a self-reported impact (mySmartfarm) around predictable performance data.

Table A33: Integrated end-to-end market linkages – ranking

Name	Ranking						
	Service offering	Potential for financial sustainability	Current scale	Impact on agribusiness investibility	Quality of the evidence	Total score	Ranking within category
Tulaa	1.5	2	1	1	1.5	7	1
Agribuddy	1.5	2	1	0	0.5	5	5
Mobigrow	1.3	1	2	1	0.5	5.8	3
Ricult	1.3	2	1	1	0.5	5.8	3
Golden Paddy	1	1	2	1	0.5	5.5	4
mySmartfarm	1	1	0	2	0.5	4.5	7
Talad	1	2	2	1	0.5	6.5	2
CROWDE	1	2	1	0	0.5	4.5	7
Htwet Toe	0.8	2	2	0	0	4.8	6
SIPINDO	0.8	2	1	0	0	3.8	8

Agriculture e-Marketplaces

These are market linkage solutions aimed at reducing the number of intermediaries and that connect individual buyers and sellers together via virtual trading marketplaces. In principle, sellers can include individual farmers, farmer groups or cooperatives that connect to buyers, but in reality, many of these

²² (RAFL, 2019)

VAS are aimed at connecting farmers directly to consumers, promoting efficiencies across value chains. This study classifies 11 of the 104 VAS as Agriculture e-marketplaces.

Table A34: Agriculture e-marketplaces – service offering

Name	Service offering						
	Input eMarket place	Information services	Farmer supply aggregation	Produce eMarket Place	Mobile payments	Financial services	Traceability
TruTrade ^{xxvii}			•	•	•	•	•
Mastercard Farmer Network ^{xxviii}			•	•	•	•	
AgroMarket Day ^{xxix}	•	•		•			
LimaLinks ^{xxx}	•	•		•			
CropChain ^{xxxi}			•	•			•
FarMall ^{xxxii}	•			•	• ²³		
Rubi ^{xxxiii}			•	•			
Zowasel ^{xxxiv}				•		•	
e-Nam ^{xxxv}				•	•		
RegoPantes ^{xxxvi}				•		•	
Farmster ^{xxxvii}				•	• ²⁴		

All of these VAS concentrate on making connections between producers and buyers, while less than 30% also offer agro-input market places. Farmer supply aggregation is offered by almost 40% of the VAS, as a way to fulfil specific demand quantities. Increasingly mobile payments and financial services are bundled with marketplaces to provide an additional layer of security for honouring the agreed transaction and to generate another income stream through transaction fees.

Table A35: Agriculture e-marketplaces – business model

Name	Location	Business model					
		Nature enterprise	Revenue model	Maturity stage	Delivery channel	Customers	Number of users
TruTrade	East Africa (2) ²⁵	Social enterprise	B2C	Start-up	– FSF (Village agents) – App	– SHF – Aggregators – Buyers – Agents	>3,750 farmers
Mastercard Farmer Network	Africa (3) ²⁶ & India	Fintech company (Mastercard), CIAT & USADF	B2C (processing fee) & Subsidized	Start-up	– App – Web – SMS	– SHFs – Agents – Vendors – Buyers	>250,000 farmers
AgroMarket Day	Uganda	Private company	B2C (Training Fees)	Start-up	– App	– Farmers – Agribusinesses – Buyers	NE
LimaLinks	Zambia	Social enterprise & MNO (Airtel)	B2B Free to farmers	Start-up	– USSD – App – Web	– Farmers – Vendors – Buyers – Consumers	>100,000 farmers
CropChain	Ghana	Tech Company (Agrocenta)	B2B	Start-up	– F2F Village entrepreneurs – Web	– Agribusinesses – SHF – Buyers	>48,000 farmers
FarMall	Kenya	AgTech company (ZUCA)	Free for farmers	Start-up	– Web	– Farmers – Buyers – Vendors – Land owners	>800 users
Rubi	Kenya	Private company (Usomi Ltd)	B2C (commission)	Start-up	– Web – App – USSD	– SHFs – Buyers	>100
Zowasel	Nigeria	Fintech company	B2C (commission and interest rates on loans)	Start-up	– Web	– Agribusinesses – Farmers – Buyers	1.2M farmers registered 12,000 verified farmers

²³ Projected

²⁴ Projected

²⁵ Kenya and Uganda

²⁶ Kenya, Uganda, Tanzania

Name	Location	Business model					
		Nature enterprise	Revenue model	Maturity stage	Delivery channel	Customers	Number of users
e-Nam	India	Government owned	B2C (processing fee) & Subsidized (Government)	Expansion	– App – Web – SMS	– SHFs – Farmer's groups – Traders – Vendors – Buyers	>12M farmers 130,000 traders >585 markets
RegoPantes	Indonesia	Tech Company (8 Villages)	B2C (Transaction and shipping fees)	Start-up	– Webb – App	– Farmers – Agribusinesses – Buyers	>100 customers as at end 2017
Farmster	Africa (2) ²⁷ , Israel & India	Private and Government Sponsored (Israel Innovation Authority)	B2C (contact fee)	Start-up	– SMS – APP	– SHF – Buyers – Farm input companies – Agro Dealers	3,000 farmers

Most of the e-marketplaces are at very early stages of development and usage across Sub-Saharan Africa and Asia. These platforms usually aim to reduce the number of intermediaries in a value chain, often excluding off-taker agribusinesses. These platforms present a trust related challenge, which is particularly difficult to overcome from the end buyer angle, and translates in low user numbers. The biggest e-marketplace by number of users is government owned (e-Nam), while the following two by size are both run by fintech companies (Zowasel and Mastercard Farmer Network). Over 70% of the VAS in this category rely on direct customer revenue as their main income stream, while only 2 (e-Nam and Mastercard Farmer Network) are partially subsidized.

Table A36: Agriculture e-marketplaces – impact

Name	Evidence Quality	Impact		
		Agro-input dealer	Farmer	Off-taker / lead firm
TruTrade		NE	– Increased bargaining power – Economies of scale – Increased incomes (4-fold)	– Sustainable supply chain – Increased income and employment opportunities
Mastercard Farmer Network		NA	– Reduced transactions costs – Increased profits	– Reduced transaction costs
AgroMarket Day		NE	NE	NE
LimaLinks	²⁸	– Increased customer outreach – Increased market share – Increased revenues – Improved business management ²⁹	– Discounted prices – Greater transparency – Increased bargaining power	– Increased income (commissions) – Increased investment opportunities – Increased transparency
CropChain (AgroTrade)	³⁰	NA	– Increased yields (40%) – Higher prices – Higher incomes (35%) – Increased food security	– Reduced food waste (25%)
FarMall		NE	NE	NE
Rubi		NA	– Economies of scale	NE
Zowasel		NA	NE	NE
e-Nam	³¹	NA	– Increased market access – Transparent pricing – Increased bargaining power – Higher prices – Higher income – Reduced payment time	– Reduced competition among traders, lead firms and buyers – Increased supply base
RegoPantes		NA	– Higher incomes	– Reduced transaction costs
Farmster		NA	– Increased bargaining power – Higher prices – Higher incomes	– Increased efficiencies

²⁷ Kenya, Israel and Tanzania

²⁸ (GSMA, 2019a)

²⁹ Projected

³⁰ (GSMA, 2019b)

³¹ (Yadav and Sharma, 2017); (NABARD, 2018)

The main takeaways from the state of the evidence on the impact of Agriculture e-marketplaces is that only 2 of the VAS within this category have conducted any sort of rigorous impact evaluation of their service. Over 60% of the VAS report the impact of the service at the off-taker level, and out of the three VAS that also offer input e-marketplaces only one (LimaLinks) reports the impact at the agro-input dealer level. The main impacts reported at the off-taker level are related to reduced investment risks (e.g. sustainable supply chain, increased transparency and reduced competition), while some related to economic benefits (e.g. reduced costs and increased incomes). At the agro-input dealer level, the impact mainly relates to reduced investment risks (e.g. increased market share, customer outreach and business management) and also increased revenues (economic benefits).

Table A37: Agriculture e-marketplaces – ranking

Name	Ranking						Total score	Ranking within category
	Service offering	Potential for financial sustainability	Current scale	Impact on agribusiness investibility	Quality of the evidence			
TruTrade	1.4	2	0	2	0.5	5.9	4	
Mastercard Farmer Network	1.1	1	2	1	0.5	5.6	5	
AgroMarket Day	0.9	2	0	0	0	2.9	9	
LimaLinks	0.9	2	2	2	1	7.9	1	
CropChain (AgroTrade)	0.9	2	1	1	1.5	6.4	3	
FarMall	0.7	1	0	0	0	1.7	11	
Rubi	0.6	2	0	0	0.5	3.1	8	
Zowasel	0.6	2	0	0	0	2.6	10	
e-Nam	0.6	1	2	2	1.5	7.1	2	
RegoPantes	0.6	2	0	1	0.5	4.1	6	
Farmster	0.4	2	0	1	0.5	3.9	7	

Financial Access

Smallholder Payment Solutions

These are mobile financial services specifically targeted at farmers and agro-input dealers or off takers. General mobile payment systems have not been included here, as they are not specifically designed to address some of the main challenges faced by smallholders and agribusinesses. This study classifies 4 of the 104 VAS as Smallholder Payment Solutions.

Table 38: Smallholder payment solutions – service offering

Name	Service offering						
	Input payment	Savings	Access to loans	Advisory services	Insurance	Produce sales	Money transfer
Agri-Wallet ^{xxxviii}	•	•	•	• ³²	• ²⁸	•	
SLIDE ^{xxxix}	•	•	•				•
Cropital ^{xl}		•	•	•	•		
Tanijoy ^{xli}			•	•		•	

All of these VAS offer access to loans, 75% also offer saving schemes and advisory services. Half of these services facilitate payments to agro-input dealers and half facilitate produce sales to off-takers. Only one of these services (Cropital) does not specifically connect to either agro-input dealers or off-takers, but it has been included here because it offers a way for investors to directly invest in smallholders.

³² Planned

Table A39: Smallholder payment solutions – business model

Name	Location	Business model					
		Nature enterprise	Revenue model	Maturity stage	Delivery channel	Customers	Number of users
Agri-Wallet	Kenya	Fintech (Dodore)	B2C (commission & premiums)	Start-up	– m-Pesa – Face to face	– SHFs – Agribusinesses – Agro input dealers – Buyers	>25,000 farmers
SLIDE	Asia (5) ³³	Fintech (iAPPS)	B2B & B2C (Service fees & commission)	Start-up	– App – e-wallet	– SHFs, – Agribusinesses – Traders, Lenders	>500 farmers
Cropital	Philippines	Social enterprise	B2C (Service Fees)	Start-up	– Web	– Investors	>700 farmers, 37,000 lenders
Tanijoy	Indonesia	AgTech (TaniGroup)	B2C (Commission & profit sharing)	Start-up	– Web – App	– Investors, Farmers – Farmer Groups – Off-takers	1,820 farmers, 1,067 Lenders

All of the smallholder payment solutions are in the start-up phase and none of the them have a user base bigger than 30,000 farmers. All of the services rely on direct customer revenue, either through commission or service fees, and none of them rely on subsidies. This highlights the higher likelihood of financial services to generate enough revenue to maintain the VAS.

Table A40: Smallholder payment solutions – impact

Name	Evidence Quality	Impact		
		Agro-input dealer	Farmer	Off-taker / lead firm
Agri-Wallet		NE	NE	NE
SLIDE		NE	NE	NE
Cropital		NE	– Improved productivity – Reduced crop losses – Increased profits – Improved empowerment	NE
Tanijoy		NE	NE	NE

The evidence of the impact of financial access is particularly scarce, with only one VAS reporting any kind of impact at the farmer level and no evidence about the impact of these services at the off-taker or agro-input dealer levels.

Table A41: Smallholder payment solutions ranking

Name	Ranking						
	Service offering	Potential for financial sustainability	Current scale	Impact on agribusiness investibility	Quality of the evidence	Total score	Ranking within category
Agri-Wallet	1.7	2	1	0	0	4.7	1
SLIDE	1.1	2	0	0	0	3.1	3
Cropital	1.1	2	1	0	0.5	4.6	2
Tanijoy	0.9	2	0	0	0	2.9	4

Supply chain management

These types of VAS are designed for agribusinesses and intend to help them manage their relationships with smallholder farmers (off take or input purchase) more efficiently, safely and profitably. Agribusinesses tend to be the primary ‘client’ and ‘user’ of most supply chain management VAS, while smallholders are beneficiaries (better integration in formal value chains, as well as higher yields and incomes) and not necessarily direct clients of these services.

³³ Myanmar, Indonesia, Thailand, Philippines, Singapore

Traceability and Certification Solutions

These types of VAS are aimed at documenting farm and processing practices to ensure compliance with standards, as well as to trace products across value chains at lower cost and higher fidelity. These types of solutions have historically focused on export markets, driven by consumer's demand for certification and compliance with quality, environmental and social standards. This study classifies 7 of the 104 VAS as Traceability and Certification Solutions.

Table A42: Traceability and certification solutions – service offering

Name	Service offering								
	On farm traceability	Advisory services	VC traceability	Inventories	M&E	Fin. svcs	Certification	Supplier assessment	Risk maps
SourceMap ^{xlii}			•		•		•	•	•
ChainPoint ^{xliii}			•	•	•		•	•	
Bluenumbr ^{xliv}	•		•				•	•	•
Sustainable Coffee Verification ^{xlv}	•	•			•		•	•	
NamLITS ^{xlvi}	•		•	•			•		
GeoTraceability ^{xlvii}	•	•	•		•				
BlockChain ForGood ^{xlviii}		•	•			•	•		

All of the VAS in this category offer either on farm or value chain traceability, and all but one also offer certification. Monitoring and evaluation is also a sub-service offered in almost 60% of the cases, as the data gathered by the service can be used to evaluate the evolution of the service over time. Only one of the VAS also offer some sort of financial services, which supports the idea that these services are mainly targeted at agribusinesses and not farmers.

Table A43: Traceability and certification solutions – business model

Name	Location	Business model					
		Nature enterprise	Revenue model	Maturity stage	Delivery channel	Customers	Number of users
Source Map	Worldwide	Private tech company	B2B	Mature	– Web (Block chain)	– Companies (MNs) – SMEs – Agribusinesses	>200,000 SHFs
Chain Point	Worldwide	Private tech company	B2B	Expansion	– SW (Cloud) – App	– Certification companies	>40,000 users
Bluenumbr	Asia (3) ³⁴	Not-for-profit (Bluenumbr Foundation)	B2B	Expansion	– Web	– Agribusinesses – MNOs – NGOs – Banks – Governments	>250,000 farmers
Sustainable Coffee Verification	Africa (2), Asia (2), Latin America (5) ³⁵	Not-for-profit (Enveritas NGO)	Free for farmers	Start-up	– App	– SHFs – Producers – Cooperatives	>3,000 farmers
NamLITS	Namibia	Government owned	B2C (fees) & Subsidized	Expansion	– Web	– Farmers – Producers	>70,000 farmers
GeoTraceability	Asia (3) ³⁶	Private company (Optel)	B2B	Mature	– Web (cloud based SaaS)	– Agribusinesses – Governments – NGOs – MNOs	98,000 farmers & >300,000 farmers profiled
BlockChainForGood	Africa (3) ³⁷ & Asia (in trial)	Not-for-profit (FairChain Foundation)	B2B & B2C	Expansion	– App – Web	– Agribusinesses – Buyers – Coffee companies	>3,000 farmers

All of the traceability and certification solutions rely on business to business revenue as their main income stream, with the exception of NamLITS, which is government owned and is partially subsidized. 3 of these VAS are run by not-for-profits and 2 of them reach less than 5,000 farmers with

³⁴ Indonesia India Myanmar

³⁵ Uganda, Ethiopia, Indonesia, Vietnam, Guatemala, Honduras, Nicaragua, Costa Rica, Columbia

³⁶ Vietnam Indonesia Malaysia

³⁷ Ethiopia, Rwanda & Kenya

their service, while the other VAS reaches over 250,000 farmers and has a sophisticated customer base (including banks, governments, MNOs and NGOs). The footprint of all but one of these VAS expand to at least 3 countries, with over half of them offering their services across different continents.

Table A44: Traceability and certification solutions – impact

Name	Evidence Quality	Impact		
		Agro-input dealer	Farmer	Off-taker / lead firm
Source Map		NE	– Improved impact assessment of interventions	– Increased transparency – Increased traceability – Reduced transport costs
Chain Point		NE	– Improved impact assessment of interventions	NE
Bluenummer		NE	NE	NE
Sustainable Coffee Verification	38	NA	– Reduced chemical use – Improved quality – Reduced environmental footprint	– Increased efficiencies – Reduced costs – Improved compliance
NamLITS	39	– Improved disease outbreak containment	– Improved cattle health – Reduced losses	– Improved operational transparency
GeoTraceability		NA	– Improved quality – Higher productivity	– Improved transparency – Increased efficiency
BlockChainForGood		NA	– Increased productivity – Improved quality – Increased revenues	– Reduced transaction costs – Increased transparency – Improved brand image

The main takeaways from the state of the evidence of the impact of Traceability and Certification solutions is that over 28% of the VAS within this category have conducted any sort of rigorous impact evaluation of their service. Over 70% of the VAS report the impact of the service at the off-taker level, and only one has evaluated the impact at the agro-input dealer level. The main impacts reported at the off-taker level are both related to reduced investment risks (e.g. increased transparency, traceability and compliance) and economic benefits (e.g. reduced costs).

Table A45: Traceability and certification solutions – ranking

Name	Ranking						
	Service offering	Potential for financial sustainability	Current scale	Impact on agribusiness investibility	Quality of the evidence	Total score	Ranking within category
Source Map	1.1	2	2	2	0.5	7.6	1
Chain Point	1.1	2	1	0	0	4.1	5
Bluenummer	1.1	1	1	0	0	3.1	6
Sustainable Coffee Verification	1.1	0.5	0	2	1.5	5.1	3
NamLITS	0.9	1	2	2	1.5	7.4	2
GeoTraceability	0.9	2	2	2	0.5	7.4	2
BlockChain ForGood	0.9	1	0	2	0.5	4.4	4

Enterprise Resource Planning (ERP)

Agricultural ERP platforms are solutions targeted at smallholder farmer cooperatives, nucleus farms or agribusiness out-grower schemes. ERP VAS aim to integrate core agribusiness processes (e.g. HR, finance, manufacturing, supply chain, services, procurement and others) into a single system, while including operational analytics, value chain intelligence, and tools for managing smallholder farmers and agent field forces. ERP services intend to improve the effectiveness and cost-efficiency of SME Agribusinesses at every level of operating scale. These VAS contribute to reducing the costs

³⁸ (Enveritas, 2019)

³⁹ (Prinsloo and Villiers, 2017)

and increasing the efficiencies of dealing with smallholders while also improving intelligence on and control over all aspects of value chain activities. This study classifies 30 of the 104 VAS as ERP.

Table A46: ERP – service offering

Name	Service offering								
	Inputs info	Farm records	Advisory services	Contract mgmt.	Financial services	M&E - certification	SME mgmt.	Market Access	Track & Trace
OFIS ^{xlix}	•	•	•	•	•	•	•		•
Connected Farmer ^l	•	•	•	• ⁴⁰	•	•	•		•
eProd ^{li}		•	•	•	•	•	•		•
FarmCloud ^{lii}	•	•	•		•	•		•	•
Agreo ^{liii}	•	•	•	•			•	•	•
Farmforce ^{liv}	•	•	•		•	•			•
CropIn ^{lv}		•	•	•		•		•	•
SourceTrace ^{lvi}	• ⁴¹	•	•		•	•		•	•
Rural Sourcing Management ^{lvii}		•		•	•	•		•	•
SmartCow ^{lviii}	•	•	•		•		•	•	
myFugo ^{lix}	•	•	•				•	•	•
DigiCow ^{lx}	•	•	•		•		•	•	
Akokotakra ^{lxi}	•	•	•		•		•	•	
EzyAgric ^{lxii}	•	•	•		•			•	•
SimpleAgric ^{lxiii}	•	•	•			•	•		•
FarmERP ^{lxiv}		•	•	•			•	•	•
Metajua ^{lxv}	•	•			•	•			•
Taro Works ^{lxvi}		•	•	•			•		•
SNS ^{lxvii}	•	•	• ⁴²	•	•				
Sen Ngunu ^{lxviii}	•	•	•				•	•	
AgriGO ^{lxix}		•	•		•		•	•	
AgriV ^{lxx}		•	•			•	•		•
Agrio ^{lxxi}	•	•	•				•		
Food Trust ^{lxxii}		•			•	•			•
Probita Farms ^{lxxiii}	•	•	•				•		
Budget Mkononi ^{lxxiv}	•	•	•				•		
Agropay ^{lxxv}	•				•		•	•	
Connected Crop Solution ^{lxxvi}	•	•	•						
neolnt ^{lxxvii}		•					•		•
Cadasta Platform ^{lxxviii}		•							•

Ninety-seven percent of the VAS in this category have farm records as one of the key sub-services they offer, 77% offer agronomic advisory services, 63% have SME management tools, 63% have connections to agro-input dealers, 60% provide track and trace, 50% offer financial services, 47% have connection to markets, 40% provide M&E and certification, and only 27% offer contract management. This highlights that the main motivation for these types of services is to gain a better understanding of what is happening at the farm level, improve the quality and quantity of the produce, while seeking a more efficient way of managing farmers and the agribusiness itself.

⁴⁰ Future release

⁴¹ Future release

⁴² Linked to government extension services

Table A47: ERP – business model

Name	Location	Business model					
		Nature enterprise	Revenue model	Maturity stage	Delivery Channel	Customers	Number of users
OFIS	Africa & Asia & Latin America ⁴³	Food company (Olam)	Proprietary service & B2B	Expansion	– App – Web	– Farm groups – Agribusinesses	>500,000 farmers
Connected Farmer	Africa (2) ⁴⁴	MNO (Vodacom)	B2B	Growth	– Web – App – SMS	– Agribusinesses – Input suppliers – Enterprises	> 900,000 registered farmers (Kenya)
eProd	Africa (11), Afghanistan & Guatemala ⁴⁵	AgTech company (eProd Solutions Ltd)	B2B (license fee)	Growth	– Web (Software) – App	– Agribusinesses – Cooperatives – NGOs – SMEs	>250,000 farmers 18 Value chains
FarmCloud	Asia (3) ⁴⁶	AgTech Company (Koltiva)	B2B	Mature	– App – Web	– Agribusinesses – MNOs	>297,000 Farmers >5,100 SMEs
Agreo	Worldwide	AgTech partnership (SMAG, InVivo Group)	B2B	Growth	– Web – App	– Agribusinesses – Cooperatives – Producer organizations	>30,000 farmers >400 sector operators
Farmforce	30 countries across Asia, Africa and Latin America	AgTech company (started by Syngenta Foundation)	B2C & B2B (licenses & subscription fees)	Expansion	– Web – Apps – SMS	– Cooperatives – Agribusinesses – Aggregators – NGOs – MNOs – SHFs	>500,000 farmers
CropIn	52 countries worldwide	AgTech Company	B2B	Expansion	– Web (SaaS) – App	– Agribusinesses – SHFs – Multilateral Organizations – NGOs	>2.1 M farmers >225 clients
Source Trace	28 countries worldwide ⁴⁷	AgTech Company	B2B	Expansion	– Software – App	– Agribusinesses – Farmer organizations – NGOs	>1 M farmers
Rural Sourcing Management	Africa (9) ⁴⁸	Tech Company (SAP)	B2B	Expansion	– Software – Web – App	– 17 organizations	>100,000 farmers
SmartCow	Kenya	AgTech company	Subsidized (Mastercard Foundation)	Growth	– App – SMS – Web	– SHFs – Agribusinesses	NE
myFugo	Kenya	AgTech company	B2C	Start-up	– App – Web – USSD	– SHFs – Agribusinesses	8,000 farmers
DigiCow	Kenya	AgTech Company (Farmingtech Solutions)	B2B & B2C (Ads, transaction & training fees)	Start-up	– App	– SHFs – Agribusinesses	>3,500 farmers
Akokotakra	Ghana	AgTech Company (AgroInnova)	B2C (subscription fees)	Start-up	– App – Website – USSD – SMS	– SHFs – Agribusinesses	>3,000 farmers
EzyAgric	Uganda	AgTech Company (Akorion Ltd.)	B2C (Profiling & service fees)	Expansion	– App – Web	– SHFs – Agents – Coops	>106,000 farmers >500 village agents
Simpleagri	Asia (4) ⁴⁹	AgTech Company (SimpleAgri Corp)	B2B, Free for SHFs	Start-up	– Web – App	– Agribusinesses – SHFs – MNOs – Cooperatives	>650 farmers

⁴³ Burundi, Cameroon, Cote D'Ivoire, DRC, Ghana, Nigeria, Mozambique, Congo, Rwanda, Tanzania, Uganda, Zambia, Indonesia, Laos, Thailand, Timor-Leste, Turkey, Vietnam, Papua New Guinea, Honduras, Mexico, Nicaragua, Guatemala, Brazil, Ecuador, Colombia, Peru

⁴⁴ South Africa & Kenya

⁴⁵ Kenya, Ethiopia, Malawi, Rwanda, Tanzania, Uganda, Ghana, Guinea and Cameroon. Senegal and Morocco – planned.

⁴⁶ Indonesia, Cambodia & Philippines

⁴⁷ Africa, Asia, Latin America & Europe

⁴⁸ Ghana, Burkina Faso, Uganda, Sierra Leone, Kenya, Burundi, Benin, Côte d'Ivoire & Mozambique

⁴⁹ Indonesia, Thailand, Philippines & Malaysia

Name	Location	Business model					
		Nature enterprise	Revenue model	Maturity stage	Delivery Channel	Customers	Number of users
FarmERP	Asia (3) ⁵⁰	Private Agtech (Koltiva)	NE	NE	- Web	- Agribusinesses - Companies	>297,000 farmers
Metajua	Africa (6) ⁵¹	AgTech company	B2B (fees)	Expansion	- Web (Software) - SMS	- Agribusinesses - Cooperatives - SMEs - Large agribusinesses	>250,000 farmers connected
TaroWorks	Worldwide	Non-for-profit Social Enterprise (Grameen Foundation)	B2B (licensing plans) B2C (Trainings)	Mature	- Web (SaaS)	- Social Enterprises - NGOs	> 200,000 farmers > 90 social enterprises
SNS	Rwanda	Government-led (Bank of Kigali)	Subsidized	Growth	- App - USSD - Website	- Farmers - Agro-dealers - Financial Institutions	>1.2M farmers registered
Sen Ngunu	Senegal	Private company (Genius)	NE	Start-up	- App - Web	- Agribusinesses - Farmers	NE
AgriGO	Rwanda	AgriTech company (Go Ltd.)	B2B (mgmt. fees) & B2C (subscription fees)	Expansion	- USSD - Web - SMS	- Coops - Farmers	>90,000 farmers 30 cooperatives
Agrivi	150 Countries Worldwide	AgTech company	B2B & B2C (subscription fees)	Start-up	- Web (software) - App	- Agro Input - Off-takers - Farmers - Government - Insurers	>40,000 farmers
Agrio	Worldwide	AgTech company (Saillog)	B2C (Subscription)	Start-up	- App - Web	- Farmer organizations - Governments - NGOs	>80,000 farmers
Food Trust	Worldwide	Tech company (IBM)	B2B	Growth	- Web (Cloud) - Block chain	- Technology providers - Agribusinesses - Lead firms	>15,000 stores >500,000 traces conducted on platform
Probity Farms	Nigeria	Tech company (Hacom Technologies)	Freemium B2C (sign-up fees for larger bundles)	Start-up	- Web (cloud based)	- SHFs - Cooperatives	> 200 farmers
Budget Mkononi (linked to iShamba)	Kenya	Not-for-profit (Mercy Corps) and social enterprise (The Mediae Company)	Free of charge	Growth	- Web	- Agribusinesses - SHF	>800 users >4,591 budgets created
Agropay	Zambia	Software company (MPS)	B2C (service fees)	Growth	- Web	- Agribusinesses	>41,400 farmers
Connected Crop Solution	India	Tech company (Accenture)	B2C & B2B	Start-up	- Web (Cloud) - App	- Farmers - Field Agents - Agro-input dealers	Pilot 1,640 farmers
neolnt	Asia (4) ⁵²	Tech company (iConcept Software Services Pvt. Ltd)	B2C & B2B	Growth	- App - Web (Cloud SaaS)	- Agro-input dealers	>3M farmers
Cadasta Platform	Kenya & Asia (3) ⁵³	Not-for-profit (Cadasta Foundation)	NE	Growth	- Web - App	- State governments - Communities - Trusts	- 30 orgs - 2.1M farmers

More than 50% of the ERP services reach over 100,000 farmers, which makes ERP the service category with the highest likelihood of reaching scale. This is probably due to the fact that agribusinesses are the main target client of these services (80% of the services with more than

⁵⁰ Philippines, India & Thailand

⁵¹ Uganda, Tanzania, Burundi, Rwanda, DR Congo & Madagascar

⁵² India, Indonesia, Malaysia & Philippines

⁵³ Myanmar, Indonesia & India

100,000 farmers rely on B2B revenue) and that less than 7% of all the VAS in this category rely on subsidies as a revenue stream, making of financial sustainability a determining factor of achieving scale. 87% of the services are run by a private company, 70% have surpassed the start-up phase and 60% have geographical footprint in more than 2 countries (27% have worldwide coverage).

Table A48: ERP – impact

Name	Evidence Quality	Impact		
		Agro-input dealer	Farmer	Off-taker / lead firm
OFIS	54	– Improved account management	– Improved quality – Increased productivity – Increased prices – Increased income – Improved bankability	– Increased efficiencies – Increased quality – Reduced certification costs – Improved transparency and traceability
Connected Farmer		– Increased farmer outreach – Increased efficiencies	– Improved productivity – Increased resilience	– Increased efficiencies – Increased productivity – Improved transparency – Reduced SHF management costs
eProd	55	NA	– Improved product aggregation	– Improved SHF management – Improved transparency
FarmCloud		NE	– Increased productivity	– Reduced carbon footprint – Increased transparency
Agreo	56	NE	– Improved productivity – Improved quality – Improved income – Decreased input costs – Reduced chemical use – Reduced labour time	– Increased compliance (reduced chemical residues)
Farmforce	57	– Improved efficiencies and sales	– Improved GAP – Improved quality – Improved market access – Increased prices	– Reduced SHF management costs – Improved compliance with standards
Cropln		NA	– Increased productivity – Increased prices – Reduced input use	– Improved efficiencies – Reduced management costs – Increased productivity
SourceTrace		NA	– Efficient use of inputs – Improved productivity – Increased market access	– Improved agricultural practices (data driven) – Improved productivity
Rural Sourcing Management	58	NA	– Increased incomes	– Increased incomes – Reduced costs – Improved transparency
SmartCow		NE	NE	NE
myFugo		NE	NE	NE
DigiCow		– Improved farmer connection	– Increased productivity (4 litres per cow/day)	– Reduced losses
Akokotakra		NE	NE	NE
EzyAgric		NE	NE	NE
Simpleagri		NE	– Increased productivity – Increased incomes	– Reduced costs – Improved product quality
FarmERP		NA	– Increased productivity – Improved quality – Reduced costs – Increased incomes	– Reduced carbon footprint – Reduced waste
Metajua		NE	– Increased productivity – Improved quality	– Reduced SHF management costs – Improved staff management
TaroWorks		NA	– Improved impact assessment of interventions	– Improved SHF management – Improved SME management – Improved marketing – Increased sales – Improved logistics
SNS	59	– Reduced information gaps	– Reduced uncertainty – Increased financial access	– Increased efficiencies (communications)
Senngunu		NE	NE	NE

⁵⁴ (FAO and ITU, 2019)

⁵⁵ (Chemeltorit et al., 2018)

⁵⁶ (smart AKIS, 2018)

⁵⁷ (World Bank, 2017b)

⁵⁸ (Elsässer, 2017)

⁵⁹ (AFR, 2018)

Name	Evidence Quality	Impact		
		Agro-input dealer	Farmer	Off-taker / lead firm
AgriGo	60	NA	<ul style="list-style-type: none"> – Increased GAP – Increased productivity – Improved prices – Reduced financial vulnerability 	<ul style="list-style-type: none"> – Improved SHF management – Improved market efficiencies
Agrivi		NA	<ul style="list-style-type: none"> – Increased GAP – Increased profits 	NE
Agrio		NE	<ul style="list-style-type: none"> – Reduced crop losses – Increased productivity 	<ul style="list-style-type: none"> – Improved SHF management – Improved SME management – Increased supply
Food Trust		NA	<ul style="list-style-type: none"> – Improved quality 	<ul style="list-style-type: none"> – Increased transparency – Increased efficiencies – Improved food safety
Probity Farms		NE	<ul style="list-style-type: none"> – Increased financial access – Improved yields (80%) – Increased income 	NE
Budget Mkononi		NE	NE	NE
Agropay		NE	NE	NE
Connected Crop Solution		<ul style="list-style-type: none"> – Increased customer outreach – Increased sales effectiveness 	<ul style="list-style-type: none"> – Improved GAP – Increased productivity – Increased incomes 	NA
neolnt		NA	NE	NE
Cadasta Platform	61	NA	<ul style="list-style-type: none"> – Improved tenure security – Increased productivity – Community empowerment 	NE

The main takeaways from the state of the evidence on the impact of ERP platforms is that only 10% of the VAS within this category have conducted any sort of rigorous impact evaluation of their service. 60% of the VAS report the impact of the service at the off-taker level, and out of the 19 services that also provide information about agro-inputs, only 30% provide an estimation of the impact at the agro-input dealer level. The main impacts reported at the off-taker level are related to reduced investment risks (e.g. increased efficiencies and transparency), while some related to economic benefits (e.g. reduced farmer management costs and increased incomes). At the agro-input dealer level, the impact mainly relates to reduced investment risks (e.g. increased customer outreach). However, the high levels of agribusiness uptake and retention of these services point to more widespread and consolidated impacts than what the current estate of the evidence suggests. These levels of uptake and retention might be used by service providers to estimate the impact of the service and therefore reduce the cost of conducting impact evaluations.

Table A49: ERP – ranking

Name	Ranking						
	Service offering	Potential for financial sustainability	Current scale	Impact on agribusiness investibility	Quality of the evidence	Total score	Ranking within category
OFIS	1.8	2	2	2	1	8.8	1
Connected Farmer	1.4	2	2	2	0.5	7.9	1
eProd	1.6	2	2	1	1	7.6	5
FarmCloud	1.6	2	2	2	0.5	8.1	3
Agreo	1.6	2	1	2	1.5	8.1	3
Farmforce	1.3	1	2	2	1.5	7.8	4
CropIn	1.3	2	2	2	0.5	7.8	4
SourceTrace	1.3	2	2	2	0.5	7.8	4
Rural Sourcing Management	1.3	2	2	2	1	8.3	2
SmartCow	1.3	1	0	0	0	2.3	21
myFugo	1.3	2	1	0	0	4.3	17
DigiCow	1.3	2	0	1	0.5	4.8	14

⁶⁰ (Hunter, 2018)

⁶¹ (Cadasta, 2016)

Name	Ranking						
	Service offering	Potential for financial sustainability	Current scale	Impact on agribusiness investibility	Quality of the evidence	Total score	Ranking within category
Akokotakra	1.3	2	1	0	0	4.3	17
EzyAgric	1.3	2	2	0	0	5.3	13
Simpleagri	1.3	2	0	2	0.5	5.8	11
FarmERP	1.3	1	2	2	0.5	6.8	8
Metajua	1.1	2	2	2	0.5	7.6	5
TaroWorks	1.1	1	2	2	0.5	6.6	9
SNS	1.1	1	2	1	1	6.1	10
Senngunu	1.1	1	0	0	0	2.1	22
AgriGo	1.1	2	2	1	1	7.1	7
Agrivi	1.1	2	1	0	0.5	4.6	16
Agrio	0.9	2	2	2	0.5	7.4	6
Food Trust	0.9	2	1	1	0.5	5.4	12
Probit Farms	0.9	2	0	0	0.5	3.4	19
Budget Mkononi	0.9	1	0	0	0	1.9	23
Agropay	0.9	2	1	0	0	3.9	18
Connected Crop Solution	0.7	2	0	0	0.5	3.2	20
neolnt	0.7	2	2	0	0	4.7	15
Cadasta Platform	0.4	0	2	0	1.5	3.9	18

Digital Quality Assurance and Anti-counterfeiting

These VAS aim to maintain the integrity and reputation of agro-input companies while ensuring the quality and authenticity of the inputs acquired by farmers. Substandard inputs reduce farmer's productivity and reduces demand for additional high-quality inputs, which translates into lower input prices and profit margins for agro-input companies. This study classifies 4 of the 104 VAS as Digital Quality Assurance Solutions for Inputs and Anti-counterfeiting.

Table A50: Digital quality assurance and anti-counterfeiting – service offering

Name	Service offering						
	Agro-input buying	Counterfeit check	Pest & disease identification	Advisory services	Agro-input marketing	Track and Trace	Customer engagement
QualiTrace ^{lxxxix}	•	•	•	•		•	
ScanTrust ^{lxxx}		•				•	•
Sproxil ^{lxxxi}		•			•		
mPedigree ^{lxxxii}		•					

This is one of the smallest service categories, based on the number of existing VAS (only 4). The counterfeit functionality is also rarely integrated within other VAS, as these services tend to be conceived as a 'push effort' from agro-input companies, trying to promote their own products as well as the integrity of the agro-input market, instead of a "pull service" demand from either farmers or off-takers requesting a system to better check the quality of the agro-inputs they buy. Contrary to the agro-input market integrator category, only one of the anti-counterfeit services is accompanied by agronomic and input advice for farmers, which helps ensure that farmers are able to fully capitalize on the use of high-quality inputs to improve the quality and quantity of their produce. Half of the services integrate traceability of the agro-input services with the anti-counterfeiting functionality. No financial services are integrated, which limits the capacity of the service to explore additional revenue streams.

Table A51: Digital quality assurance and anti-counterfeiting – business model

Name	Location	Business model					
		Nature enterprise	Revenue model	Maturity stage	Delivery channel	Customers	Number of users
QualiTrace	Ghana	AgTech company	B2C & B2B	Start-up	– USSD – SMS – App	– SHFs – Retailers – Farmer-based organizations	7,400 farmers 55 input retailers
ScanTrust	80 countries worldwide	Tech company	B2B	Start-up	– Web – App	– MNOs – Governments	50M products >200 farmers
Sproxil	Africa (5) & Asia (2) ⁶²	Tech company	Spread across industries	Maturity	– SMS – App – Call centre – Web	– Farmers – Consumers – Retailers	> 3,000 farmers (Kenya)
mPedigree	Africa (10) & Asia (3) ⁶³	Social enterprise	Spread across industries	Expansion	– SMS – Web – App	– Product owners – agro-input industries – Governments	Imprinted on 6.5m products across industries

Compared to other VAS categories, digital quality assurance solutions for inputs and anti-counterfeiting can be applied across industries (beyond agriculture) without making many changes to the business model and delivery streams, which offers an opportunity to share costs and revenues across industries. This service category was originally conceived for the pharmaceutical industry and it has only in recent years been expanded to agricultural inputs.

Table A52: Digital quality assurance and anti-counterfeiting – impact

Name	Evidence Quality	Impact		
		Agro-input dealer	Farmer	Off-taker / lead firm
QualiTrace		NE	NE	NE
ScanTrust		– Increased customer loyalty – Increased incomes (higher customer willingness to pay)	– Improved input quality	NE
Sproxil		NE	NE	NE
mPedigree		– Increased customer loyalty – Increased incomes (higher customer willingness to pay)	– Improved input quality	NE

The main takeaways from the state of the evidence on the impact of digital quality assurance solutions for inputs anti-counterfeiting is that none of the VAS within this category have conducted any sort of rigorous impact evaluation of their service. Two out of the four VAS report the impact of the service at the agro-input dealer level, and none analyse how these services can impact off-takers further up the chain. The main impacts at the agro-input dealer level are increased customer loyalty (reduced investment risks), as well as increased incomes and farmer’s willingness to pay (economic benefits).

Table A53: Digital quality assurance and anti-counterfeiting – ranking

Name	Ranking						
	Service offering	Potential for financial sustainability	Current scale	Impact on agribusiness investibility	Quality of the evidence	Total score	Ranking within category
QualiTrace	1.4	2	1	0	0	4.4	3
ScanTrust	0.9	2	0	2	0.5	5.4	1
Sproxil	0.6	2	0	0	0	2.6	4
mPedigree	0.3	2	0	2	0.5	4.8	2

⁶² Nigeria, Kenya, Ghana, Mali, Tanzania, India & Pakistan

⁶³ Egypt, Ghana, Kenya, Nigeria, Tanzania, Rwanda, Sierra Leone, South Africa, Uganda, Zambia, India, Bangladesh & Pakistan

Logistic Management Solutions, Storage and Transport

These are VAS that support the operations of transport and physical storage infrastructure of agricultural products throughout a segment of the whole value chain. These services are conceived to promote efficiencies, transparency and to reduce complexity in value chains. This study classifies 4 of the 104 VAS as logistic management solutions.

Table A54: Logistic management solutions, storage and transport – service offering

Name	Service offering				
	Business intelligence	Supply chain management tools	Physical infrastructure	Digital payments	Performance monitoring
Virtual City ^{lxxxiii}	•	•		•	•
Logistimo ^{lxxxiv}	•	•		•	•
iProcure ^{lxxxv}	•	•	•		
Weight Capture ^{lxxxvi}		•		•	

All of the VAS in this category offer different tools for supply chain management. Three out of 4 VAS also offer business intelligence and another 3 offer digital payments. The integration of both business intelligence and digital payments point to the importance of promoting visibility and transparency of the value chain as a key driver for these kinds of services. One of the services (iProcure) also offers warehousing services for agro-inputs.

Table A55: Logistic management solutions, storage and transport – business model

Name	Location	Business model					
		Nature enterprise	Revenue model	Maturity stage	Delivery channel	Customers	Number of users
Virtual City	Africa (4) ⁶⁴	Tech company	B2B	Expansion	– App	– Agribusinesses – Cooperatives – Input suppliers	>300,000 farmers
Logistimo	Africa (5) & Asia (3) ⁶⁵	Tech company	B2B	Expansion	– Web (cloud)	– NGOs – Multilateral organizations – Governments – SMEs	>600M beneficiaries
iProcure	Kenya	Private company	B2B	Start-up	– Web – App – USSD	– Suppliers – Retailers – Farmers – Agri-input manufacturers	>5,000 retailers >7,000 dairy farmers
Weight Capture	Africa (2) ⁶⁶	Tech Company (CAPTURE Solutions Ltd)	B2B	Start-up	– Web – App	– Agribusinesses – Cooperatives	>30,000 farmers

All of the logistic management solutions rely on business to business revenue as their main income stream, with the exception of iProcure, which is partially subsidized. All of these VAS are run by not-for-profits and two of them reach over 300,000 farmers and have a complex customer base (including agribusinesses, agro-input companies, governments and NGOs). The footprint of all but one (iProcure) of these VAS expand to at least 2 countries

⁶⁴ Kenya, Uganda, Rwanda, Tanzania

⁶⁵ South Sudan, Uganda, Zambia, Mozambique, India, Indonesia & Myanmar

⁶⁶ Kenya & Tanzania

Table A56: Logistic management solutions, storage and transport – impact

Name	Evidence Quality	Impact		
		Agro-input dealer	Farmer	Off-taker / lead firm
Virtual City		<ul style="list-style-type: none"> – Increased efficiencies – Reduced fraud – Increased transparency – Increased income 	<ul style="list-style-type: none"> – Increased income – Increased value chain connection and visibility – Increased financial inclusion 	<ul style="list-style-type: none"> – Increased efficiencies – Reduced fraud – Increased transparency – Increased sales
Logistimo		NE	NE	NE
iProcure		NE	NE	NE
Weight Capture		NE	NE	NE

The main takeaways from the state of the evidence on the impact of logistic management solutions for storage and transport is that none of the VAS within this category have conducted any sort of rigorous impact evaluation of their service. Only one of the VAS (Virtual City) report the impact of the service at the off-taker and agro-input levels. The main impacts reported at the off-taker and agro-input levels are related to reduced investment risks (e.g. improved efficiencies, transparency and reduced fraud), while some related to economic benefits (e.g. increased sales).

Table A57: Logistic management solutions, storage and transport – ranking

Name	Ranking						
	Service offering	Potential for financial sustainability	Current scale	Impact on agribusiness investibility	Quality of the evidence	Total score	Ranking within category
Virtual City	1.6	2	2	2	0.5	8.1	1
Logistimo	1.6	2	2	0	0	5.6	2
iProcure	1.2	1	1	0	0	3.2	4
Weight Capture	0.8	2	1	0	0	3.8	3

Macro Agricultural Intelligence

Out of the different Macro Agriculture Intelligence VAS, this study has prioritized commercial solutions over government and donor agri-intelligence platforms. Commercial Macro Agri-Intelligence solutions tend to be marketed to a wider variety of end-users, including agribusinesses, governments and the private sector, while government and donor led platforms tend to be targeted at government extension networks primarily. Some private led Macro Agricultural Intelligence VAS (e.g. Dalberg’s CubicA, Microsoft’s AI for Earth, or aWhere) have not been included in this study because they are either more targeted at governments or do not reach smallholder farmers. This study classifies 7 of the 104 VAS as Macro Agricultural Intelligence.

Table A58: Macro agricultural intelligence – service offering

Name	Service offering							
	Demand modelling	Crop mapping	Tailored data surveying	Yield forecasting	Weather data	Agronomic suitability	Disease risk modelling	Production & stock forecasting
Gro Intelligence ^{lxxxvii}	•	•		•	•	•	•	•
Advance AI driven analysis ^{lxxxviii}		•		•	•	•	•	•
HARA Token ^{lxxxix}		•		•	•	•	•	
6 th Grain ^{xc}		•		•	•		•	
ACRE ^{xcii}		•		•	•	•		•
Next Billion Agri Marketplace ^{xciii}	•	•		•				•
Akvo Flow and Lumen ^{xciii}		•	•					

All of the VAS in this category offer crop mapping and all but one offer yield forecasting. In 70% of the VAS, crop mapping and yield forecasting is layered with weather data, and in almost 60% of the cases with agronomic suitability, pest and disease risk modelling, as well as stock forecasting. Only 2 out of the 7 VAS offer demand modelling, which offers greater visibility over the supply and demand dynamics throughout the value chain.

Table A59: Macro agricultural intelligence – business model

Name	Location	Business model					
		Nature enterprise	Revenue model	Maturity stage	Delivery channel	Customers	Number of users
Gro Intelligence	Kenya, America (2) and China ⁶⁷	Tech Company (Gro)	B2B (subscription fees)	Mature	– Web – Software (SaaS)	– Agro-input – Agribusinesses – Food & beverage – Financial sector	>1M datasets
Advance AI driven analysis	Indonesia, Malaysia & U.S.A.	AgTech Company (Adatos A.I)	B2B	Start-up	– Web	– Agro-input manufacturers	NE
HARA Token	Indonesia	AgTech company (Hara Technology Pte Ltd and Dattabot)	B2B (Transaction Commission)	Start-up	– App – Web	– Data buyers – Financial institutions – Governments – Input suppliers – Off takers	>31,300 farmers in 741 Villages
6 th Grain	Africa (16) & Middle East (3) ⁶⁸	Tech company (SatSure)	B2B	Mature	– App – Web. (software)	– Farmer organizations – Agribusinesses – Government agencies	>66M hectares mapped
ACRE	Worldwide	Consulting Company (McKinsey)	B2B	Mature	– Web (software & cloud) – App	– Agro-input companies – Traders – Farm operators – Governments	>40,000 hectares
Next Billion Agri Marketplace	Asia (8), South Africa, Turkey & Poland ⁶⁹	Social Enterprise	B2B	Growth	– App – Web	– Farmer organizations – Agribusinesses – SHFs	>16,000 Farmers
Akvo Flow and Lumen	> 70 countries worldwide	Non-profit (Akvo)	B2B	Mature	– App – Web	– NGOs – Governments – Multilateral organizations – MNOs – Food & beverage companies	>200 organizations > Thousands of users in >70 countries

All of the macro agricultural intelligence solutions rely on business-to-business revenue as their main income stream. Accurate information about the number of users or farmers reached is remarkably unavailable compared to other VAS, which highlights that these services are conceived with the aim of improving visibility and efficiencies throughout a value chain instead of having an impact at the farmer level. The footprint of all but one of these VAS expand to at least 3 countries, all of them offering their services across different continents.

⁶⁷ U.S.A and Brazil

⁶⁸ Tanzania, Kenya, Malawi, Mozambique, Zambia, Zimbabwe, South Africa, Lesotho, Swaziland, Angola, DRC, Nigeria, Morocco, Tunisia, Algeria, Egypt, Syria, Iran & Iraq

⁶⁹ India, Bangladesh, Myanmar, Thailand, Cambodia, Philippines, Vietnam & Indonesia

Table A60: Macro agricultural intelligence – impact

Name	Evidence Quality	Impact		
		Agro-input dealer	Farmer	Off-taker / lead firm
Gro Intelligence		NE	NE	NE
Advance AI driven analysis		NE	NE	NE
HARA Token	70	– Increased customer outreach	– Improved input access – Increased productivity – Improved market visibility – Increased financial inclusion – Reduced climate risks	NE
6 th Grain		– Improved efficiencies	– Improved productivity – Increased GAP	– Improved efficiencies
ACRE		NE	NE	– Improved transparency – Reduced decision time
Next Billion Agri Marketplace		NE	– Increased income diversification – Increased income	– Reduced costs – Improved SME management – Reduced transportation time
Akvo Flow and Lumen		NE	– Increased productivity – Improved livelihoods – Reduced environmental footprint	– Improved monitoring & evaluation – Improved financing reporting

The main takeaways from the state of the evidence on the impact of Macro Agricultural Intelligence is that none of the VAS within this category have conducted any sort of rigorous impact evaluation of their service. Sixty percent of the VAS report the impact of the service at the off-taker level, and 30% assess the impact at the agro-input dealer level. The main impacts reported at the off-taker level are related to economic benefits (e.g. improved efficiencies and reduced costs) and reduced investment risks (e.g. reduced time). At the agro-input dealer level, the impact mainly relates to reduced investment risks (e.g. increased customer outreach) and also improved efficiencies (economic benefits).

Table A61: Macro agricultural intelligence – ranking

Name	Ranking						Total score	Ranking within category
	Service offering	Potential for financial sustainability	Current scale ⁷¹	Impact on agribusiness investibility	Quality of the evidence			
Gro Intelligence	1.8	2	0.5	0	0	4.3	5	
Advance AI driven analysis	1.5	2	0	0	0	3.5	6	
HARA Token	1.3	2	1	1	1	6.3	1	
6 th Grain	1.0	2	0.5	1	0.5	5	4	
ACRE	1.3	2	0.5	1	0.5	5.3	3	
Next Billion Agri Marketplace	1.0	2	1	2	0.5	5.5	2	
Akvo Flow and Lumen	0.5	1	1	2	0.5	5	4	

Value-chain integrated services

Those solutions that deliver a fully integrated digital value proposition to smallholder farmers and other agricultural value chain intermediaries are defined as value-chain integrated services. These VAS bundle all or part of the main service categories outlined above (i.e. advisory and information services, market linkages, financial access, supply chain management and macro agricultural intelligence). Bundling different types of services together increases the likelihood of obtaining enough revenue streams to promote financial resilience and sustainability, while maximizing the potential impact at the agribusiness and farmer levels of the services. This study classifies 11 of the 104 VAS as value-chain integrated services.

⁷⁰ (Uzsoki and Guerdat, 2019)

⁷¹ Those services for which the exact data about customers is not available have been marked with 0.5

Table A62: Value-chain integrated services – service offering

Name	Service offering				
	Advisory & Information Services	Market Linkages	Financial Access	Supply Chain Management	Macro Agricultural Intelligence
Farm to Market Alliance ^{xciv}	•	•	•	•	•
	•	•	•	•	•
Agrikore ^{xcv}	•	•	•	•	•
Rural Taobao ^{xcvi}	•	•	•	•	•
Farmerline ^{xcvii}	•	•	•	•	•
N-Frnds ^{xcviii}	•	•	•	•	•
AgUnity ^{xcix}	•	•	•	•	•
MyCrop ^c	•	•	•	•	•
ListenField ^{ci}	•	•	•	•	•
Eragano ^{cii}	•	•	•	•	•
EcoFarmer ^{ciii}	•	• ⁷²	•	• ⁶⁸	•

Seventy-three percent of the VAS in this category bundle all 5 main categories of services (advisory and information services, market linkages, financial access, supply chain management and macro agricultural intelligence). The remaining 27% of the VAS bundle 4 out of the 5 main service categories. Advisory and information services, market linkages and supply chain management are the 3 main categories that are present in all value-chain integrated services.

Table A63: Value-chain integrated services – business model

Name	Location	Business model					
		Nature enterprise	Revenue model	Maturity stage	Delivery channel	Customers	Number of users
Farm to Market Alliance	Africa (4) ⁷³	PPP (AGRA, Bayer, Rabobank, Syngenta, WFP & Yara)	Subsidized	Expansion	– App – F2F	– SHFs, Off-takers – Input suppliers – Aggregators – Agribusinesses	>135,000 Farmers 60 Private Partners
ATA Ethiopia	Ethiopia	Government Agency	Subsidized	Mature	– F2F – SMS – IVR	– Government – Regional Government – Cooperatives	NE
Agrikore	Africa (3) Afghanistan ⁷⁴	FinTech company (Cellulant)	B2C (commission)	Expansion	– Web (Blockchain) – App – SMS – USSD	– Farmers – Agro-dealers – Financial inst institutions – Governments	>15 million farmers
Rural Taobao	China & Africa	e-commerce company (Alibaba)	B2C (service fees)	Mature	– Web (cloud) – App	– Farmers, – Farmer groups – Service centres	>30,000 villages
Farmerline	Ghana	Tech company	B2C & B2B	Growth	– USSD, Web – Voice – SMS	– SHF – Farmer groups	>200,000 farmers
N-Frnds	Indonesia & Rwanda	Tech company	B2B (farmer data & commission fee); free for farmers	Start-up	– USSD – Web (SaaS)	– Agribusinesses – Financial Institutions – MNOs, Governments	>15M users
AgUnity	Africa (4), Asia (2) & Latin America (2) ⁷⁵	AgTech Social Enterprise (AgriLedger Hong Kong Charitable Trust)	B2C & B2B (suppliers pay 10% commission)	Start-up	– App – Web	– MFIs, NGOs – Cooperatives – Buyers, Traders	>200,000 farmers
MyCrop	Asia (2) ⁷⁶	AgTech Company	B2C (commission)	Start-up	– App – Web	– Agro-input companies – Finance institutions – Buyer companies	>4,000 farmers

⁷² Future release

⁷³ Kenya, Rwanda, Tanzania and Zambia

⁷⁴ Nigeria, Liberia, Afghanistan & Togo

⁷⁵ Kenya Ethiopia Uganda, Sierra Leone Indonesia, Papua New Guinea, Colombia and trinidad and Tobago

⁷⁶ India & Indonesia

Name	Location	Business model					
		Nature enterprise	Revenue model	Maturity stage	Delivery channel	Customers	Number of users
						– Governments	
ListenField	Thailand	AgTech company	B2B Free for farmers	Start-up	– App – Web	– Service providers – Universities – Companies	>7,000 farmers
Eragano	Indonesia	AgTech company	B2C (Commission fees)	Start-up	– App	– Farm supply producers	>5,000 farmers
EcoFarmer	Zimbabwe	MNO (Econet)	B2C (subscription fees); initially Subsidized	Mature	– USSD – SMS – Web – App – IVR	– SHFs – Agribusinesses – Farmer organizations – Input suppliers – Buyers	>700 000 farmers

Sixty-three percent of the value-chain integrated services rely on business to customer revenue as their main income stream, 27% rely either fully or partially on subsidies, and 27% generate business to business revenues. This supports the idea that bundling different services together, particularly with financial services, under one VAS contributes to increasing farmers' willingness to pay and makes the reliance on B2C revenues viable to achieve financial sustainability for the whole service. Listen Field is the only VAS that does not bundle financial services and it fully relies on B2B revenue, which points to the importance of financial services, and charging commissions, as a key factor to generate direct customer revenue. Forty-six percent of the VAS reach over 200,000 farmers and none of them rely on subsidies as an income stream, plus they use at least 2 different delivery channels for the service provision. Forty-six percent of the VAS are only present in one country, and 18% are present in only two countries, which indicates that expanding the geographical footprint of these services might be more complex than for other services like Macro Agricultural Intelligence, which often have a global footprint.

Table A64: Value-chain integrated services – impact

Name	Evidence Quality	Impact		
		Agro-input dealer	Farmer	Off-taker / lead firm
Farm to Market Alliance		– Increased farmer outreach – Increased income	– Improved GAP – Increased productivity – Improved prices – Increased incomes	– Increased supply reliability – Increased supply – Increased efficiencies
ATA Ethiopia		NE	NE	NE
Agrikore		NE	NE	NE
Rural Taobao	77	– Increased market outreach	– Improved productivity – Reduced input costs	– Increased value addition – Improved market access
Farmerline	78	– Improved input distribution – Improved farmer outreach	– Improved GAP – Increased productivity – Increased incomes – Increased financial inclusion	– Improved transparency – Improved SME management
N-Frnds		NE	NE	NE
AgUnity	79	NE	– Improved market access – Increased incomes – Increased access to finance – Improved trust between farmers	– Increased productivity – Increased income – Increased predictability of supply
MyCrop		NE	– Reduced costs (production) – Increased productivity – Increased incomes	– Improved stock management
ListenField		NE	– Reduced climate uncertainty	NE
Eragano		NE	– Reduced costs – Increased incomes – Increased savings	NE
EcoFarmer		NE	NE	NE

⁷⁷ (CTA, 2019)

⁷⁸ (Olerety, 2018); (CFS, 2015)

⁷⁹ (Schuurmans, 2018); (IIX, 2019); (FAO and ITU, 2018)

The main takeaways from the state of the evidence on the impact of value-chain integrated services is that less than 18% of the VAS within this category have conducted any sort of rigorous impact evaluation of their service. 64% of the VAS report the impact at the farmer, 45% of the VAS report the impact of the service at the off-taker level, and 27% estimate the impact at the agro-input dealer level. The main impacts reported at the off-taker level are related to reduced investment risks (e.g. increased predictability of supply), while some related to economic benefits (e.g. increased revenues). At the agro-input dealer level, the impact mainly relates to reduced investment risks (e.g. increased customer outreach) and also increased revenues (economic benefits).

Table A65: Value-chain integrated services – Ranking

Name	Ranking value-chain integrated services						
	Service offering	Potential for financial sustainability	Current scale	Impact on agribusiness investibility	Quality of the evidence	Total score	Ranking within category
Farm to Market Alliance	2.0	1	2	2	0.5	7.5	4
ATA Ethiopia	2.0	0	0	0	0	2.0	8
Agrikore	2.0	2	2	0	0	6.0	5
Rural Taobao	2.0	2	1	2	1	8.0	3
Farmerline	2.0	2	2	2	1.5	9.5	1
N-Frnds	2.0	2	2	0	0	6.0	5
AgUnity	2.0	1	2	2	1.5	8.5	2
MyCrop	2.0	2	0	2	0.5	6.5	4
ListenField	1.6	2	1	0	0.5	5.1	6
Eragano	1.6	2	1	0	0.5	5.1	6
EcoFarmer	1.2	1	2	0	0	4.2	7

End Notes

- ⁱ Farmers Pride leverages technology and franchizing (DigiShoP) to give Kenyan farmers access to high quality inputs via an online mobile platform that connects farmers to the nearest verified vets, agronomy, inputs and insurance service providers, as well as real time climate information. <https://farmersprideafrica.com>
- ⁱⁱ One Acre Fund integrate digital technologies into their value chain work. https://www.usaid.gov/sites/default/files/documents/15396/One_Acre_Fund_Case_Study.pdf
- ⁱⁱⁱ Babban Gona is an investor-owned social enterprise serving small networks of smallholder farmers to demonstrate that the smallholder segment is a viable model for investment and to attract massive new capital to the sector. <https://babbangona.com/>
- ^{iv} Safaricom's DigiFarm is focused on using a combination of digital technologies and its physical network of partner organization field agents to link Kenyan farmers to agricultural inputs, along with input financing, and increasingly more tailored advisory services. <https://www.safaricom.co.ke/business/digifarm/what-is-digifarm/digifarm>
- ^v iProcure is a digital B2B start-up working on optimizing the agricultural input supply chain in Africa. <https://iprocu.re>
- ^{vi} myAgro mobile VAS savings model for agri-input financing that operates by linking the aggregated farm input demand from smallholder farmers to high-quality input suppliers via local agro-dealer stores. <https://www.myagro.org/>
- ^{vii} Tun Yat is an on-demand platform connecting farmers and machine renters, using mechanization to improve farmer yields. Tun Yat offers a standardized service across a fragmented market; offering an affordable and reliable tractor/harvester rental service. <https://tunyat.com/>
- ^{viii} CowTrive is a Ghana-based for-profit organization focused on supporting livestock farmers via a mobile platform that aggregates demand for livestock farming inputs and services. <https://www.cowtribe.com/>
- ^{ix} Farmshine is a global agriculture platform that enables smallholder farmers to aggregate and sell their harvests directly to large commodity companies. <http://farmshine.io/>
- ^x Selina Wamucii is a platform that helps businesses from anywhere in the world to buy and import food & agricultural produce from any African country with ease. It simplifies sourcing, payments, and logistics while guaranteeing trust for buyers and producers. www.selinawamucii.com
- ^{xi} Taimba provides rural small-scale farmers in Kenya with direct linkages to urban traders. <https://taimba.co.ke/>
- ^{xii} FarmerLink, developed by Grameen Foundation, uses digital technology and field agents to provide farmers with complimentary resources. These include agricultural training via tablets or mobile phones, connections to high-value markets, support for organic certification, early warning alerts for extreme weather and pests, training in financial management and access to finance. <https://growasiadirectory.org/farmerlink/>
- ^{xiii} Soko Yetu is a mobile-based B2B food supply platform run by Twiga Foods, which is combined with physical infrastructure for farmer engagement, produce aggregation, and transport logistics that supplies fresh fruits and vegetables in Kenya. <https://twiga.ke/marketplace/>
- ^{xiv} LOOP is a result of Digital Green's foray into agriculture output markets focused on streamlining market linkages to directly increase smallholder farmers' incomes www.getloopapp.com
- ^{xv} Trade Ghana uses digital technology melded with a physical agent and storage warehouse network to play the role of maize value chain integrator in Ghana. <https://www.tradeghana.co/>
- ^{xvi} iFarms' flagship product, Umá, adds earning opportunities for producers / farmers to reach markets and fulfil the demand. This is achieved by creating reliable partnerships for producers, providing them with relevant information like actual demands and market trends with transparent pricing across the value chain. (<https://ifarms.ph/>)
- ^{xvii} Tulaa has a unique digitally-enabled end-to-end value chain formalization business model, providing pre-screened quality inputs on credit to smallholder farmers and then brokers the sale of farmers' crops at harvest time. <https://www.tulaa.io/>
- ^{xviii} Agribuddy connects farmers to resources and networks. Their digital platform is both a mobile application and a web application, which farmers use alongside a "buddy" to store data and order supplies as needed. Agribuddy enables farmers to have access to capital through bank loans, as well as higher quality farm inputs. <https://www.agribuddy.com/>
- ^{xix} MobiGrow program is a 5 year partnership program between the MasterCard Foundation and KCB Group Limited that targets agricultural value chain actors to offer mobile-based financial inclusion and

information to smallholder farmers and pastoralists in Kenya and Rwanda.

<https://agriprofocus.com/post/5d776f0126b72a368566065f>

^{xx} Ricult improves the lives of smallholder farmers in Thailand through a data-driven mobile platform that helps farmers improve farming productivity and reduce cost. Leveraging machine learning to model weather forecast, soil data, and satellite imagery, Ricult provides data-driven recommendations and insights to farmers to make the best possible farming decision to increase their income.

<http://www.ricult.com/?lang=0>

^{xxi} Golden Paddy offers real-time, specific and accurate productivity advice, connection to better buyers with better prices and terms, and connection to formal lenders with better rates and terms. All services are free for farmers, with Golden Paddy generating revenue from lead generation, advertisements, data insights and transactions. <https://www.impactterra.com/>

^{xxii} While a farm advisory platform, the mySmartfarm platform also connects farmers directly with sellers and buyers to help raise farmer incomes, as well as, create sustainable livelihood for smallholder farmers in Asia. <https://smartfarmsnetwork.com/>

^{xxiii} The Talad App helps farmers find and hire farm workers. Additionally, it allows users to buy & sell agricultural related products and hire mechanics to fix machinery. Through the direct connection of all parties, Talad aims to reduce the cost of buying and selling agricultural related products and services.

<https://talad.co/en/home/>

^{xxiv} CROWDE is an agriculture-focused fintech start-up that empowers farmers across Indonesia with technology and capital. It is a farmer-friendly financing ecosystem that connects investors seeking attractive returns with farmers that are looking for capital to grow. <https://www.crowde.co/>

^{xxv} Htwet Toe is a simple and easy to use mobile platform that helps agricultural communities in Myanmar by providing professional advice, solutions and services to increase yield and productivity in the Agricultural sector. <http://www.htwetoe.com/>

^{xxvi} SIPINDO is an application that solves a wide range of common smallholder farmer challenges, helping them increase their incomes through shared information about their crop performance to supply chain actors from upstream to downstream. The application is used by farmers, buyer – consumer and agriculture practitioners and also support ±150 field officers of EWINDO <http://www.panahmerah.id/home>

^{xxvii} TruTrade is a social enterprise providing smallholder farmers with a reliable route to market and fair prices for their produce. <http://www.trustradeafrica.net/>

^{xxviii} MasterCard Farmer Network in Kenya, Uganda, Tanzania and India this solution aims to systemically integrate smallholder farmers from loose value chains with quality buyers via a digital transaction marketplace for individual sellers and buyers. <https://www.mastercard.us/en-us/about-mastercard/corp-responsibility/social-sustainability/the-mastercard-labs-for-financial-inclusion.html>

^{xxix} Online trading platform for inputs and produce with access to e-learning.

<http://www.agromarketday.com/>

^{xxx} LimaLinks in Zambia is a mobile based farmer platform to connect farmers, suppliers and buyers.

<http://www.limalinkszambia.com/>

^{xxxi} CropChain is a platform for facilitating trade between smallholder farmers and consumers or buyers in Ghana. <https://agrocenta.com/apps>

^{xxxii} FarMall is a comprehensive one stop platform for buying and selling inputs, produce, machinery and land. <https://farmallke.co.ke/>

^{xxxiii} Rubi is a platform that virtually aggregates farm produce from farmers across the East African region.

<https://www.usomi.com/rubi/>

^{xxxiv} Zowasel is an online commodity trading platform for grains and cash crops with a built in alternative financial solution for growers and agribusinesses to grow their trade and improve their livelihoods.

<http://www.zowasel.com/>

^{xxxv} National Agriculture Market (e-NAM) is a pan-India electronic trading portal which networks the existing APMC mandis to create a unified national market for agricultural commodities. <https://enam.gov.in/>

^{xxxvi} RegoPantes is a platform that connects consumers/businesses to the farmers directly. Through RegoPantes consumers/businesses can manage their purchases with regards to quality, shipping method and/or amount and shipping time of their products. <https://www.regopantes.com/>

^{xxxvii} Farmster is a digital platform connecting farmers to buyers without requiring internet access

<https://www.farmster.co/>

^{xxxviii} Agri-wallet is an innovative mobile business account to save, borrow and pay for income generating activities to increase food security and fight poverty. <https://agri-wallet.com/>

^{xxxix} Slide is an integrated fintech platform that enables supply chain stakeholders to gain access to capital. The platform facilitates lending from financial institutions, impact investors or through crowdfunding, and mitigates risks by establishing a closed-loop supply chain. <https://www.iappsasia.com/project/slide/>

^{xl} Cropital is a financing platform for smallholder farmers, connecting farmers to lenders, insurance providers, technology, and market. Cropital has a two-sided marketplace catering to both farmer-borrowers and individual lenders. <https://www.cropital.com/>

^{xli} Tanijoy is a sharia agriculture investment platform that empowers local smallholder farmers through investments, end-to-end technical assistance. <https://www.tanijoy.id/syariah>

^{xlii} Supply chain mapping software that enables companies to trace products to the source – tracking social, financial, and environmental risks at every step of the value chain: www.sourcemap.com

^{xliii} Software platform for monitoring and securing supply chains. Customers include the Rainforest Alliance and the Better Cotton Initiative www.chainpoint.com

^{xliiv} Bluenumber (B#) is a digital ID to uniquely identify People, Organizations, Places or Things, and show how these specific entities relate to each other in complex systems such as supply chains. Buyers will know who is in the supply chain, what their practices are and how they are demonstrated. <https://www.bluenumber.com/en/>

^{xliiv} Enveritas is an international NGO that provides innovative and data-driven sustainability verification programs for coffee. <https://www.enveritas.org/approach/>

^{xlivi} Launched by the Namibian government in 2006 for commercial farmers and extended to communal livestock farmers in 2014 <http://www.namlits.com/>

^{xliivii} OPTEL's GeoTraceability technology offers powerful solutions for data collection and analysis, providing qualitative and quantitative data to track and authenticate raw materials. GeoTraceability puts smallholders on the map – giving them the opportunity to participate in supply chains that are connected via data, and to give them the standing as independent businesses. <https://www.optelgroup.com/geotraceability-solution/>

^{xliiviii} Blockchain provides a reliable and transparent system for tracking every single transaction in the value chain, right down to what smallholder farmers are paid and when. <https://fairchain.org/blockchainforgood/>

^{xlix} Olam Farmer Information System is an in-house agriculture value chain digitalization tool to support Olam's operations <https://www.olamgroup.com/sustainability/reimagine/olam-farmer-information-system.html>

ⁱ Links enterprizes to smallholder farmers through the transfer of industry-related information <https://www.vodacombusiness.co.za/business/solutions/internet-of-things/connected-farmer>

ⁱⁱ App for managing large numbers of suppliers: <https://www.eprod-solutions.com/>

ⁱⁱⁱ Koltiva's Farm Cloud is a cloud based web and mobile software applications for project and supply chain management are customized and tailor-made to clients' business processes. <https://koltiva.com/>

^{liii} Agreo is the software solution for agri business professionals and offers farmers a real global management tool for their farm allowing them to plan, organize and supervise all of their seed production operations, from planning through to logistics and invoicing of batches, to marketing. https://en.smag.tech/app/uploads/2018/12/SMAG_agreo-SEEDS_EN.pdf

^{liiv} Cloud-based mobile platform that facilitates management of smallholder farming schemes: <https://farmforce.com/>

^{liv} Business to business decision making tool <https://www.cropin.com/>

^{livi} Focus on large-scale agribusinesses <https://www.sourcetrace.com/>

^{liivii} Designed for agribusiness companies and powered by the SAP Cloud Platform, this software connects smallholder farmers to the agricultural value chain <https://www.sap.com/products/agriculture-supply-chain-mgmt.html>

^{liiviii} SmartCow offers advisory features but also enables pre-commercial and commercial farmers to monitor their expenditure and income and to capture and analyse the history of each and every animal including the production levels for milk. This VAS is now being targeted at dairy cooperatives too. <https://frp.org/finance-oriented/inuka-africa>

^{lix} MyFugo is a record-keeping and value chain aggregator in the dairy industry that seeks to increase farmer productivity and profitability by addressing problems such as rampant disease outbreaks, lack of access to market and inadequate skilled veterinary doctors. <https://www.myfugo.com/>

^{lx} DigiCow is a simple record-keeping app for dairy farmers which targets smallholder farmers and enterprizes engaged in dairy farming with data driven decision-making. <http://digicow.co.ke/>

^{lxii} AkokoTakra is a farm management software for Ghanaian poultry farmers to record, monitor, keep track and analyse all their farm operations <https://www.akokotakra.com/>

^{lxiii} Akorion's EzyAgric solution in Uganda combines digitally-supported input and off-take market linkages with a network of youth service provider village agents equipped with smartphones. <https://ezyagric.com/>

^{lxiii} SimpleAgri digitizes farm management by capturing the day to day operational processes giving full transparency and traceability that then enables landholders to make incremental changes for improving productivity, worker safety, quality and produce yields. http://eng.simpleagri.com/?page_id=783

^{lxiv} FarmERP is an end-to-end software solution from “farm to fork” that helps smallholder farmers increase their efficiency and profitability. FarmERP simplifies the management of farming, harvesting, packing and retailing, and helps farmers match the market’s demands. This results in reduced inventory losses, full traceability and increased field staff mobility. <http://www.vishwaaminfotech.com/> <https://www.farmerp.com/>

^{lxv} Focus on small to medium-sized African agribusinesses, typically with a range of 1,000 to 20,000 smallholder farmers being managed per each agribusiness ‘account’ <https://metajua.com/>

^{lxvi} Cross sector app, including agriculture. It is a product of the Grameen Foundation but it is integrated with the Salesforce (Customer Relationship Management platform) <https://taroworks.org/>

^{lxvii} The Smart Nkunganire System (SNS) is a supply chain management system built by BK TecHouse Ltd in collaboration with Rwanda Agriculture and Animal Resources Development Board (RAB) to digitalize the end to end value chain of the Agro-Input Subsidy program <https://smartnkunganire.rw/>

^{lxviii} Sen Ngunu is a solution to manage the entire production chain of a poultry farm. <http://sennunu.com/>

^{lxix} AgriGo is an advisory platform with some farm management components including recordkeeping of all farmer purchases and activities. [https://i2ifacility.org/system/documents/files/000/000/069/original/AgriGO - A farmer's financial tool to grow greater financial harvest i2i July 2018.pdf?1532604835](https://i2ifacility.org/system/documents/files/000/000/069/original/AgriGO_-_A_farmer's_financial_tool_to_grow_greater_financial_harvest_i2i_July_2018.pdf?1532604835) ; <https://www.linkedin.com/company/agrigorw/about/>

^{lxx} Agrivi is a VAS for pre-commercial and commercial farmers, as well as agricultural cooperatives or large enterprises, available in over 150 countries worldwide. <https://www.agrivi.com/en>

^{lxxi} The Agrio App is an AI-based alert system for agriculture. This smartphone app provides guidance on integrated pest management, surveillances the spread of pests and diseases, dispatches warning alerts for impending infestations in affected areas and high risk zones, and enables communication between farmers and agriculture experts. However, it also has a B2G model that provides governments and nonprofits access to a macro-level dashboard solution. <https://agrio.app/>

^{lxxii} IBM Food Trust is the first blockchain food safety solution that allows transaction partners to confidently and securely share food information <https://www.ibm.com/blockchain/solutions/food-trust>

^{lxxiii} Probity Farms is an advisory solution for smallholder farmers and coops (Probity Coop) that also offers farm and coop management, inventory, and accounting. Offers an investor functionality to keep track of the investment. <https://probityfarms.com/>

^{lxxiv} BudgetMknoni is a farm budgeting and recordkeeping application for smallholder farmers. <https://budgetmknoni.com/>

^{lxxv} Agropay is an integrated transactional, operational and administrative platform for the agricultural sector. Built and managed by Mobile Payment Solutions. <https://agropay.online/>

^{lxxvi} Focus on serving the needs of medium-sized and large agribusinesses. Aims to connect field agents, agri-input companies and farmers <https://www.accenture.com/cn-en/insight-accenture-digital-agriculture-solutions>

^{lxxvii} neolnt is a traceability platform for agri-input manufacturers. While most solutions in the market only focus on product serialization, neolnt helps agribusiness professionals manage business processes related to Channel inventory and Channel Loyalty across the finished goods value chain from factory to farmer. <http://www.neoint.ai/>

^{lxxviii} Cadasta develops and promotes the use of simple digital tools and technology to efficiently document, analyse, store, and share critical land and resource rights information. Farmers can gain a better understanding of their landholdings, ensure traceability of their product and increase security of their land rights. <https://cadasta.org/>

^{lxxix} QualiTrace is a traceability and anti-counterfeiting company that uses track and trace technology to authenticate product farm inputs and outputs. <http://qualitracegh.com/>

^{lxxx} ScanTrust is a smart packaging company that provides solutions to product authentication, supply chain traceability and consumer engagement. Through the patent, copy-proof QR codes, cloud-based business intelligence software and blockchain technology, ScanTrust helps brands digitize their physical products and enable two-way communication with end-consumers. <https://www.scantrust.com/>

^{lxxx1} Venture Capital company providing mobile authentication services for identification of counterfeit products <https://sproxil.com/>

^{lxxxii} Mobile and web technologies for securing products against faking, counterfeiting and diversion. <https://mpedigree.com/>

^{lxxxiii} Virtual City technology firm that develops and delivers supply chain automation solutions in East Africa <https://www.virtualcity.co.ke/>

^{lxxxiv} Logistimo deploys technology to secure supply chains for health, energy & agriculture <https://www.logistimo.com/>

^{lxxxv} iProcure - combines digital logistics surveillance, analytics, and supply chain management tools with a physical network of agri-input agents and warehouses that help agribusiness aggregate and optimize smallholder input supply chains. <https://iprocu.re/>

^{lxxxvi} WeightCapture combine technologies for temper-proof digital weighing of produce with software that monitors the progress of agricultural products across value chains with digital tracking at key hand-off points <http://www.weightcapture.com/>

^{lxxxvii} Gro Intelligence is the world's most extensive agriculture data platform, which automatically transforms big data it into knowledge, and uses machine learning to make predictions. <https://gro-intelligence.com/>

^{lxxxviii} Adatos provides analysis on key crop performance metrics using AI to interpret huge amounts of multispectral and SAR data from satellites. <https://www.ados.com/>

^{lxxxix} HARA uses a blockchain-based traceable and transparent data exchange to drive the use of informed data-driven decisions in society to address food insecurity. HARA provides farmers and other players in the agricultural sector with valuable data. https://haratoken.io/about_us.html

^{xc} Digital agriculture technology company which focuses on transforming farmer-provided data into information that can be used to increase success and uptake in crop protection services, credit provision, and high yielding seeds. <https://www.6grain.com/>

^{xci} Agriculture Commodity Research Engine (ACRE) is McKinsey's agricultural advanced-analytics centre, with a team of agronomists, data scientists, industry experts, and software engineers experienced in applying analytics to challenges across the food system. <https://www.mckinsey.com/industries/agriculture/how-we-help-clients/acre>

^{xcii} Next Billion's Agri Marketplace enables individual farmers or organizations to make farm management and output data available and share fair value from monetized data assets - creating a new channel to lift local livelihoods. <https://www.nextbillion.asia/marketplace>

^{xciii} Akvo Flow is a smartphone-based data collection tool that captures geographically referenced data through an Android app while Lumen is Akvo's data platform which allows users to combine different datasets, analyse and visualize their data in online dashboards. <https://akvo.org/flow-caddisfly-lumen/>

^{xciv} The Farm to Market Alliance helps smallholder farmers receive relevant information, investment and support from seed to market <https://ftma.org/>

^{xcv} Blockchain based smart-contracting, payments and marketplace system that connects farmers, FMCGs, agriculture inputs providers, produce aggregators, insurance companies, financial institutions, governments and development partners <https://www.cellulant.com/agrikore/>

^{xcvi} Rural Taobao uses a combination of digital technologies and human networks to more closely link China's farmers and rural hinterlands to the economic growth engine of urban China and, ultimately, to global trade networks. <https://agra.org/wp-content/uploads/2019/09/CTA-Digitalisation-report.pdf>

^{xcvii} Farmerline offers a market driven integrated platform to provide oversight of the whole value chain while promoting access to advice and markets to farmers. <https://farmerline.co/>

^{xcviii} N-Frnds is transforming smallholder farmer value chains by providing access to finance, agricultural information, collection data and interactive communication and engagement solutions, all through the farmers' existing mobile phone. <http://www.nfrnds.com/>

^{xcix} AgUnity helps the smallest farmers in developing countries with a blockchain and smartphone solution to build trust, reduce food waste and increase farmer efficiency. <https://www.agunity.com/>

^c MyCrop is a collaborative platform, which creates an ecosystem enabled by state-of-the-art technology, to empower the farmers through Farmer Mitras (village level entrepreneurs) delivering them information, expertise, and resources. It aims to uplift the farmers' lives and better their standard of living by increasing their productivity and profitability. <http://mycroptech.in/>

^{ci} ListenField provides precision technology to empower farmers and interconnect stakeholders, creating a new economy for food production. Their app, FarmAI uses IoT integration, predictive analytics for climate and crop growth, and satellite imagery analysis in one mobile app. Farmers are connected to wholesale buyers, adding transparency and removing the need for agents. <https://www.listenfield.com/>

^{cii} Eragano offers a range of solutions for farmers who are otherwise trapped by middle men. Eragano connects farmers to lenders, who giving them access soft loans. This helps farmers buy good quality inputs, while they also receive guidance and financial literacy training – all through the mobile app. <http://eragano.com/>

^{ciii} EcoFarmer is a platform developed by Econet, to deliver agriculture services to smallholder farmers via USSD and SMS <https://www.ecofarmer.co.zw/>



Commercial Agriculture for Smallholders and Agribusiness

