



# How can digital solutions help to feed a growing world?

An introduction with case studies

# How can digital solutions help to feed a growing world?

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The Syngenta Foundation for Sustainable Agriculture (SFSA) would like to thank EY ([www.ey.com](http://www.ey.com)) for support in preparing this paper. We particularly acknowledge the work of Fabian Moreira-Phillips, Adam Welbourne and Kyle Newell from Ernst & Young LLP, London UK.

SFSA and EY are united in the belief that digital solutions can and should serve smallholder farmers. Combined with the right business and delivery models and capabilities, these tools can help the half a billion smallholders around the world improve their incomes, livelihoods and resilience.

This paper addresses three questions:

- How can organizations make better business decisions on how to better support smallholder farmers (SHFs), and use digital solutions to do so?
- How do digital solutions support sustainable agriculture, and what are the broader benefits to SHFs and their communities?
- What is the way forward in creating and scaling up the reach and impact of sustainable digital agriculture solutions?

We don't claim to have all the answers. But we hope that this discussion paper will help key organizations across the sector ask the right questions. We also hope that the answers stimulate the growth and development of enterprises using digital technologies for sustainable agriculture. Our overarching aim is to improve the livelihoods of smallholders and their communities, while increasing the food security of a growing global population.

SFSA welcomes your feedback on this report, the tools it mentions, and our own work in this field.

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Editorial completion May 2019. EY collected the case study numbers for workforce, business size, etc. in early 2019.

An abridged version of this paper is available on request.

## **Executive Summary**

Over two billion people rely on agriculture for their livelihoods. The sector is plagued by inefficiencies. Many farmers live in the poorest parts of the developing world. One in nine people goes to bed hungry. At the same time, some 30% of food production goes to waste, and \$1tn are lost along the value chain each year <sup>[1]</sup>.

Despite these challenges, there is widespread confidence that the agricultural sector has the potential to feed the world's growing population, and lift hundreds of millions out of poverty. Important reasons for this positive view lie in smallholder farming and digital innovation.

SHFs are potentially a huge force in agriculture, but are often marginalized. Collectively, empowered with the right tools, environments and knowledge, they could lead a transformation.

The digital revolution has already transformed numerous business sectors. It is now gathering momentum in agriculture. Digital innovation needs to move beyond large-scale farming operations to benefit more SHFs as well. There are already good examples of its ability to do so. Digital tools can make smallholder farming more resilient, productive and profitable.

The pace of change is accelerating, and innovations are constantly emerging. There is, however, still much to be done. Public and private organizations, NGOs, social enterprises and impact entrepreneurs are all engaged in sustainable agriculture, and can all deliver impact.

Our paper sets out an Operational Review Framework, showcases digital solutions and describes key success factors. The Framework includes practical tools for internal assessments. It enables organizations to take a holistic view of their portfolios, review impact along the value chain, and plan future strategies. SFSA and EY agriculture specialists developed the Framework in consultation with a broad range of external organizations. The Operational Review Framework also helped the authors to understand and showcase digital solutions that are transforming the sector. The key success factors guide organizations seeking to increase the impact of their digital solutions.

While preparing this paper, the authors identified three recurring themes for organizations to bear in mind:

**‘Digital’ is an enabler, and not a solution in itself.** The right infrastructure and delivery models must be in place. They must be linked to developing and implementing solutions that address the entire value chain. A holistic approach drives greater value-creation and impact across agriculture.

**The ‘field force’ must be equipped to drive change.** This field force comes in several forms, including agri-entrepreneurs, field officers, agents and aggregators. It is frequently the gateway between innovative organizations (and their solutions), markets, and smallholder farmers. Broad collaboration is a key enabler of scale-up.

**Commercial viability is key to driving innovation.** Numerous enterprises are entering the agricultural sector across the developing world. Some of these have accelerated the development of powerful new solutions. Governments should provide the right governance, legislation and infrastructure to support commercial operations, while ensuring equitable value-add for producers as well.

This paper showcases innovations and organizations transforming agriculture (in particular those enabling the field force to achieve more impact, cost-effectively), and provides a practical measurement framework. In doing so, it aims to increase momentum across one of the world's most critical industries.

[1] “SAVE FOOD: Global Initiative on Food Loss and Waste Reduction,” FAO, Retrieved 11 January 2019 from [www.fao.org/save-food/resources/keyfindings/en/](http://www.fao.org/save-food/resources/keyfindings/en/)

## How can digital solutions benefit sustainable agriculture?

### Introduction: 17 SDGs and many more challenges

Agriculture is crucial for achieving many of the 17 Sustainable Development Goals (SDGs). Specifically, SDG 2, “Zero Hunger”, calls for transformation of the global food system; “Investments in agriculture are crucial to increasing the capacity for agricultural productivity, and sustainable food production systems are necessary to help alleviate the perils of hunger”. Today, however, in a world that produces enough food for everyone, 820 million people still go to bed on an empty stomach. Many others suffer from nutrient deficiencies.

Directly or indirectly, over two billion people rely on agriculture for their livelihoods. Many of them form some of the poorest sections of society. Smallholder farmers (SHFs) are crucial for achieving SDG 1: No Poverty. When given the tools to succeed, SHFs increase not only their harvests, but also their incomes. They can therefore send more children to school for longer, which in the long term further stimulates local economies and reduces poverty. Farming leads the way here: the World Bank believes that investing in agriculture is 11 times more effective in lifting people out of poverty than any other sector [2].

However, SHFs face multiple challenges. They lack access to quality inputs, financing, insurance, markets and transport. They often also lack up-to-date knowledge on the most appropriate technologies and practices to grow, harvest, store and market better crops. Understandably, SHFs furthermore tend to be risk-averse. They do not want to invest up front in new tools and practices when a bad season can ruin their livelihoods.

Four of the many challenges faced across the smallholder sector are:

- **Poor market linkages and high numbers of intermediaries.** In developing countries, there are an average of ten intermediaries on food’s journey ‘from farm to fork’. This not only causes considerable insufficiency, but also means that SHFs only receive a small percentage of the consumer value of their output.
- **Lack of Access to Finance.** Globally, the small farms sector would like to borrow more than \$200 billion. Only about a quarter of that is serviced. This sum includes credit both for SHFs themselves and the small & medium-sized enterprises that provide them with critical services. Credit bottlenecks can prevent SHFs from buying required inputs at the right time, and may force them to sell produce quickly at harvest, when market prices are low. Lack of financing options can also hinder SHFs from tapping into new opportunities in the value chain.
- **Ageing farming populations.** Worldwide, farmers’ average age is about 60 [3]. Many young people do not see farming as an attractive profession. Use of more efficient technologies can partially offset the lack of labor. But rural emigration is a major concern in many developing countries.
- **Inadequate ‘enabling environments’.** Sustainable agriculture requires suitable infrastructure, business environments and government support. These are often missing in developing nations.

[2] FAO, IFAD, and WFP. “*The State of Food Insecurity in the World 2015: Meeting the 2015 International Hunger Targets: Taking Stock of Uneven Progress*”. Rome: FAO, 2015

[3] [www.theguardian.com/global-development-professionals-network/2014/feb/04/global-food-security-old-age-timebomb](http://www.theguardian.com/global-development-professionals-network/2014/feb/04/global-food-security-old-age-timebomb), retrieved 24 December 2018



## Driving the digital agenda

This paper argues that digital innovation provides a huge opportunity to address challenges facing the global food chain. It is already doing so on a large scale in many developed nations. Examples include satellite-supported and sensors facilitating ‘precision agriculture’, as well as data analytics enabling the most efficient cultivation in a given setting.

Many such technologies are now also serving developing countries. They include business support tools, artificial intelligence-based agronomic solutions, and satellite imagery used for insurance pricing and weather prediction. The first generation of digital agriculture solutions focused on solving specific inefficiencies in the value chain. There is now a shift towards holistic solutions that address multiple challenges, or at least integrating several individual solutions in a common delivery model.



Whilst not in the scope of this paper, it is also important to mention ‘enabling’ technologies and environments that facilitate the digital solutions. Examples include 3G connectivity, cloud storage, regulations/standards, and increasingly ‘digitally literate’ younger populations. The more prevalent such enablers are, the greater the likelihood of success. Younger SHFs are increasingly accustomed to digital technologies; big data can drive better planning, transportation, supply and allocation of inputs, finance, and outputs. At the 2019 Global Forum for Food and Agriculture, 74 Agriculture Ministers committed to facilitating digitization to drive productivity [4].

This paper argues that the time is right to accelerate the use of digital tools in sustainable agriculture. Such solutions can dramatically reduce the costs of engaging and supporting smallholders, and better integrate a complex web of value chain stakeholders.

### The scope of this paper

These are challenging and exciting times for organizations operating across sustainable agriculture. The sector seems close to developing scalable solutions that integrate SHFs into value chains. The Syngenta Foundation for Sustainable Agriculture (SFSA) is among the organizations doing so. Like many others, SFSA aims to develop scalable, sustainable solutions to improve the incomes, livelihoods and resilience of pre-commercial SHFs and their communities. This paper seeks to showcase success stories of how digital solutions can help feed an ever-growing world.

Combining SFSA’s social mission and the market-driven approach of Ernst & Young LLP (EY), this paper addresses three main questions:

- How can organizations make better business decisions on how to better support smallholder farmers (SHFs), and use digital solutions to do so?
- How do digital solutions support sustainable agriculture, and what are the broader benefits to SHFs and their communities?
- What is the way forward on creating and scaling up the reach and impact of sustainable digital agriculture solutions?

[4] “Global Forum for Food and Agriculture Communiqué 2019”, retrieved 30 January 2019 from [www.bmel.de/SharedDocs/Downloads/Landwirtschaft/Welternahrung/GFFA\\_2019\\_Kommunique\\_EN.pdf?\\_\\_blob=publicationFile](http://www.bmel.de/SharedDocs/Downloads/Landwirtschaft/Welternahrung/GFFA_2019_Kommunique_EN.pdf?__blob=publicationFile)

## Method and structure

Preparation of this paper included development of a comprehensive Operational Review Framework. This Framework sets out critical elements of the agriculture value chain. It also provides tools and guidelines that allow organizations to review their own operations and assess gaps in their offerings. The next section, *The Agriculture Value Chain and Review Framework*, provides an overview, guidance on use, and tools for the internal review.

The second part of the paper focuses on the organizations and digital solutions studied. We did not assess the nine organizations, but used the Review Framework to understand the scope of their offerings and the digital solutions involved (see *Digital Agriculture in Practice* section). We provide lessons learnt from these innovative organizations and desk research. The paper concludes with success factors for implementing sustainable digital solutions across agriculture in the developing world.

Many of the case studies are based on site visits. Where these were not possible, we used in-depth interviews and key data points. The people involved also gave feedback on the Operational Review Framework, as did a number of agriculture specialists at SFSA and EY.

# **The Agriculture Value Chain Operational Review Framework**

## **Overview**

The Framework is designed for organizations/impact entrepreneurs working directly with SHFs. It provides a practical toolset to review their own portfolios and understand how digital tools can develop their solutions and services. The Framework has three components;

- **Internal Impact Review Tool** - The review tool allows an organization to understand its current impact, cost to serve and feasibility to scale. The first step is to understand the organization's operations and reach in greater detail, before conducting the gap analysis.
- **Agriculture Value Chain Gap Analysis** – This is an end-to-end view of the components/capabilities required across the agriculture value chain. It helps organizations understand how far-reaching their operations are, and where there are gaps in current offerings. Each component of the value chain should be reviewed to understand whether additional digital capability/functionality is required to address gaps.
- **Digital Roadmap Considerations** – Following the identification of future functionality, this component facilitates understanding of the technical requirements to successfully develop a roadmap for implementation.

**We intend to continue developing the Framework with practical examples. We urge all readers to comment and share examples of its use. Please write to [syngenta.foundation@syngenta.com](mailto:syngenta.foundation@syngenta.com)**

## **Guidelines**

The tools in this Framework can be tailored to suit individual organizational needs. For example, in the Internal Impact Review, questions and weightings can be amended to match one's own priorities.

An overview of the components follows below, together with guidance on how to use the associated tools. Each section includes documentation to guide users through the Framework assessment. We recommend that users see this exercise as a holistic review across their whole organization, and take the time to engage with a broad range of stakeholders/colleagues.



The intended audience for this Framework are organizations that work directly with SHFs. However, other key agricultural players can also use it to better understand their impact and improve efficiency.

## **Internal Impact Review Tool**

The Internal Impact Review helps organizations understand the sustainability and impact of their digital operations with SHFs. It uses quantitative and qualitative questions, and three lenses:

**Impact.** Measuring the overall outcome of an organization's operations and their effect on the main customer, SHFs. The core metric is increase in SHFs' income, whilst also understanding reach and breadth of services delivered by the organization.

**Cost.** Understanding the investment required to stand-up, support and expand the operations.

**Scale.** Evaluating the sustainability and potential reach of the solution by understanding the feasibility of extending it to more SHFs.

There are twelve questions, which each attribute a weighted score. The scoring mechanism provides guidance on the core components, and can be tailored to match different regions, organizational maturity and solution types. The version below illustrates the structure. The embedded document provides details in a more easily legible form.



Impact Review  
Tool.xlsx

Criteria						
Category	#	Criteria question	Description	Weighted Score	Scoring definition	Attributed Score
IMPACT	1	Do the organization's operations increase the revenue of the smallholders and entrepreneurs with whom it interacts?	A key challenge to the 500m smallholder farmers across the globe is the return on investment (time and money). For many farming is the only source of income to support families, local communities and to further develop their lands. This question seeks to understand what the financial impact is of the organization (and its associated solutions/programs) to the income of smallholders.	9	Solution increases revenue by 40% +	6
				6	Solution increases revenue by 30% +	
				3	Solution increases revenue by 20% +	
	2	How many smallholder farmers (SHFs) are enabled by the organization's operations?	There are 500m smallholder farmers that rely on farming for their livelihood. A vast majority of these farmers require support to enhance their livelihood and sustainable agriculture places a big emphasis on impacting as many SHFs as possible. This question looks at an overarching impact of the solution by looking at the number of impacted farmers in totality.	6	50,000+	6
				4	10,000-50,000	
				2	0-10,000	
	3	What is the number of services delivered by the organization's operations?	There are a multitude of services that enable more effective farming practices for smallholders. Examples include logistics, inputs, finance, insurance, crop management, production management, market access, market information, education. This question seeks to understand overall impact in regards to services received.	3	4+	3
				2	2-3	
				1	1	
	4	Of the services identified as critical within the region, how many are addressed by the organization's operations?	This question seeks to understand the impact the solution/tool has on the specific region/country where it is being deployed (or planned on being deployed). Due to the varying challenges to sustainable agriculture across the globe, this is an important question to understand the solutions 'fit' to its target audience.	3	75-100% of critical services/requirements	1
				2	50-75% of critical services/requirements	
				1	0-50% of critical services/requirements	
	5	How many additional benefits are delivered through this organization's operations?	Sustainable agriculture is critical in large parts of the world due to the wider impact it can have on communities that rely on farming as a livelihood. This question seeks to understand, as well as sustainable farming (and the delivery of associated benefits for smallholders), what are the other benefits enabled by the solution/tool. Examples include: greater access to education, greater involvement of women in agriculture, greater food security, better employment opportunities and increased social mobility.	3	4+	3
				2	2-3	
				1	1	
	6	Which market types are made more accessible through the organization's operations?	Smallholders are dependent on markets to sell their produce to and so another way of understanding a solution/tool's sustainability is to understand the accessibility to markets and the type of markets these encompass.	3	Local and Regional Markets with the opportunity to evolve into Export markets	3
				2	Local and Regional Markets	
				1	Local Markets only	
Impact Score Total						22
Category	#	Criteria question	Description	Weighted Score	Scoring definition	Attributed Score
COST	7	What is the expense of the organization's operations, per farmer, to stand-up in a new geography?	When assessing the investment required, this criteria question looks at the cost to stand up the organization's program(s), taking into account total costs and dividing it by total number of farmers that are projected to be impacted.	6	<\$10 per farmer	2
				4	<\$50 per farmer	
				2	>\$100 per farmer	
	8	What is the expense of the organization's operations, per farmer, to maintain/provide on-going support?	When assessing the sustainability of the organization's operations, this question seeks to understand associated costs with maintaining on-going support to farmers once the solution has been established.	6	<\$5 per farmer	2
				4	<\$10 per farmer	
				2	<\$100 per farmer	
	9	What are the costs to the organization, per unit/region, of expansion?	When assessing the sustainability of the solution and following the overall ambition of delivering as much impact as possible with the amount of funding available, this question looks at costs to expand operations.	3	<\$2,000	2
				2	<\$5,000	
				1	<\$15,000	
	10	What is the number of farmers required to break even?	This question looks at the number of farmers required before the solution is self-sustaining (i.e. does not cost the organization anything additional following the up front investment). This is important to understand as the sooner a solution is self sustaining, the sooner resources (capital) can be assigned to new initiatives.	3	0-10,000	1
				2	10,000-30,000	
				1	30,000+	
Impact Score Total						7
Category	#	Criteria question	Description	Weighted Score	Scoring definition	Attributed Score
COST	11	What is the amount of capital required to achieve the scale required to reach a membership of 50,000 SHFs?	This is the total cost to effectively scale the solution. Often scalability cannot be achieved piecemeal and so it is important to quantify the cost to effectively scale at mass.	6	\$0 - \$25,000	6
				4	\$25,000 - \$100,000	
				2	\$100,000+	
	12	What time period would it take to scale the solution/solution to reach a membership of 50,000 SHFs?	This question seeks to understand the time commitment required to scale the solution/solution, which along with cost considerations, is critical for planning purposes.	3	<6 months	3
				2	6-18 months	
				1	>18 months	
Impact Score Total						9
Total Review Score						38
Example of Impact Review Input Sheet and 'Heatmap'						70.37%

## Agriculture Value Chain Gap Analysis Tool

The Agriculture Value Chain Gap Analysis Tool maps out value chain components and sub-components. These in turn set out the required capabilities, services and other considerations. The holistic view enables organizations and impact entrepreneurs to understand how far-reaching their solutions are. They can also see how these could address more of the value chain, in particular through further digital features.



The Gap Analysis tool asks two questions about each sub-component;

- Does this contribute to achieving the organization's mission statement?
- Is there a digital solution in place?

By answering these questions, the tool generates a 'heatmap' to show where digital solutions could drive greater impact. This highlights focus areas for development of future solutions.



Value Chain Gap Analysis.xlsx

<b>Mission Statement:</b> A statement that succinctly describes <i>what</i> your organization does, <i>how</i> it does it and <i>why</i> it does it. <b>Example Mission Statement:</b> "We focus on smallholder farming productivity by educating and empowering smallholder farmers in Asia, so that they can attain greater prosperity for them and their local communities"										
<b>Planning</b>					<b>Inputs</b>					
<b>Land Registration</b>	<b>Planning Guidance</b>	<b>Land Preparation</b>	<b>Farm Management</b>	<b>Initial Assessment</b>	<b>Digital Profiles</b>	<b>Create awareness of product</b>	<b>Quality Confirmation</b>	<b>Access to Finance</b>	<b>Demand Prediction</b>	
Enable farmers to gain title to the land they own/farm and/or manage administrative requirements. Provides legitimacy when applying for finance/making contractual arrangements	SHFs better plan what and when to plant. Factors that inform these decisions could range from market, to weather to land conditions (including soil health data)	Work with mechanization entities to connect tractor service companies to SHFs/Cooperatives. Broader preparation techniques can also be critical	SHFs are better able to make business decisions on cash flow, collaboration and maximizing profit through better access to critical farming data	Survey & document what is already known about the farmers/local environment in order to curate a planning solution for them	SHFs have a digital profile to better access digital innovations in the regions that link them to a wider selection of suppliers	Some branded materials are provided to field agents/lead farmers, such as aprons and t-shirts. This helps build awareness of support available/promote the initiative	Reduce counterfeit risks to buyers through mediation and monitoring of inputs quality	Provide convenient, tailored and secure ways for farmers to purchase, save, and receive credit inputs that can be paid back in-line with harvest cycles	Enable farmers to know demand in advance through better engagement with markets/buyers and/or access to market information	
Sub-Component critical?	Yes	Yes	Yes	Yes	Somewhat	Yes	Yes	Yes	Yes	
Solution in place?	No	In Pipeline	Yes - Fit for Purpose	Yes - Fit for Purpose	No	Not Fit for Purpose / Requires development	Not Fit for Purpose / Requires development	Not Fit for Purpose / Requires development	Not Fit for Purpose / Requires development	In Pipeline
<b>Production</b>					<b>Logistics</b>					
<b>Digital Diagnostics/Support</b>	<b>Behavioral Change</b>	<b>Digital Production Support/Education</b>	<b>Production Cycle/ Yield Monitoring</b>	<b>Production Enablement</b>	<b>Transport to farmer</b>	<b>Short term storage</b>	<b>Deliver to offtake</b>	<b>Quality</b>	<b>Feedback Loops</b>	<b>Supply Chain Transparency</b>
Leverage imaging tech to diagnose crop disease/pest infestation. Use applications to provide guidance on best practice to treat crop disease / pest control	Use behaviour change media to promote best practices among farmers. Establish network of change agents / entrepreneurs to advocate best practice within cooperative communities	Increase precision and/or adaptability of farming interventions and crop choices through applied data and education on best practice. Can be digitally enabled / through the use of field agents and digital platforms to enable learnings	Drive greater visibility of production yields to better coordinate the value chain and to make financing more accessible. Provide timely reminders/alerts for weather, planting and application timescales via mobile platforms	Innovative tools/machinery/ equipment that drives efficiencies in farming production. Examples include irrigation systems, planting technologies, soil health monitoring and mechanized equipment	Deliver inputs/products to farmers from input providers in a cost-effective and timely manner	Reduce post harvest loss with digitally-enabled harvest loans and digitally warehouse receipts	Deliver products from farmers to off-takers by reducing costs of transport through greater transparency. Increase choice of different types of transport for farmers and increase access to information for when transport is arriving	Grading of production quality at collection points. The more grading done at the point of aggregation the more leverage is given to the SHFs as they understand the quality of their product before buyers enter the equation	Feedback is gathered at the distribution point and provided in real time to farmers to improve their productivity and to have transparency within the marketplace	Track supply chain for optimisation and real sourcing data
Sub-Component critical?	Yes	Yes	Yes	Yes	Somewhat	Somewhat	Yes	Somewhat	No	No
Solution in place?	Yes - Fit for Purpose	Yes - Fit for Purpose	Yes - Fit for Purpose	Not Fit for Purpose / Requires development	Not Fit for Purpose / Requires development	In Pipeline	In Pipeline	In Pipeline	N/A	N/A
<b>Markets</b>			<b>Value Addition</b>		<b>Key External Component of the Ecosystem</b>					
<b>Relationship Management</b>	<b>Marketing Information</b>	<b>Access to Consumers</b>	<b>Automated Equipment</b>	<b>Supply Chain Management</b>	<b>Customer Data Systems</b>	<b>Savings and Money Security</b>	<b>Insurance</b>	<b>Broader Access to Finance</b>		
Tighten relationship with buyers and broader customer base. This can be enabled through digital tools, better connecting SHFs to key players	Increase farmer negotiating power by providing market prices and other market information that better inform SHFs on the value of their produce	Connect processors and directly to consumers by-passing traditional sales channels. Additionally expansion of market access (e.g. from local to regional markets) provides new demand for SHFs/Cooperatives	Predictive maintenance can be delivered through the monitoring of farm machinery and leveraging live performance data. Synchronized equipment can improve productivity by reducing manual efforts through greater automation of farming equipment	Improve and maintain strong relationship with input suppliers, buyers and processors. This can be enabled through digital tools, better connecting SHFs to key players	Develop better customer/market data to better forecast future demand. Digital solutions enable greater interactions with customers and the recording of transactions	Mobile money can facilitate savings, which in turn offers security of cash (digitally stored) and also access to savings products to improve livelihoods	Most SHF farmers do not often have access to insurance which increases the risk and lack of financing available within the markets. Improved credit assessments, better access to weather and production yield data can facilitate this more tailored products	A key enabler is access to financing to facilitate SHFs livelihood throughout the season. Often lack of credit history and rigidity of lenders products means access to finance is limited. Again better access to weather and production yield data can facilitate this more tailored products		
Sub-Component critical?	Somewhat	No	No	Somewhat	No	No	No	No	No	
Solution in place?	No	N/A	N/A	No	N/A	N/A	N/A	N/A	N/A	N/A

Example populated Gap Analysis Sheet - areas highlighted in red should be focus areas in future

In the case examples below, we illustrate applications of the analytical tool.

## Technical/Digital roadmap considerations

Digital solutions rarely operate in isolation. If considered on a stand-alone basis, they can quickly turn into roadblocks rather than enablers. This section considers important aspects of the development and deployment of future digital tools.

1. **Custom-built vs Standard tooling:** Once the digital needs have been identified and initial solutions designed, the organization needs to consider how to implement. The two basic models are investing in a custom-built solution or adopting a standard solution (if available). There are four main criteria for the decision. These are the level of in-house skills for initial development and continuous improvement, the time and effort required to complete the solution, the timespan for implementation (for example, phased roll-out across various countries), and the available budget.

2. **Third-party interoperability:** The ability to exchange information and cross-utilize applications with other organizations is crucial for providing holistic solutions to SHFs. Digital solutions need to be designed/evaluated in this light. Data-sharing must be secure, and functionality able to be localized (e.g. the user interface in local languages, and adherence to local security and data protection standards). We believe that to accelerate smallholder agricultural transformation partner organizations need to focus on the complementary nature of their digital services, thus creating further value for SHFs.
3. **Dissemination channels:** Information and user access can be delivered through a variety of channels. The choice normally depends on local conditions. These include internet penetration, smartphone use, and familiarity with existing interfaces. Solutions should enable use of various channels, especially those with a large local coverage. This will also aid cost-efficiency when expanding to other regions.

# Digital Agriculture in Practice

## Introduction

This section evaluates the business models and technologies currently deployed by SFSA and eight other organizations. The core focus is on how the solutions generate impact. A service overview is provided for each organization. Each case study indicates:

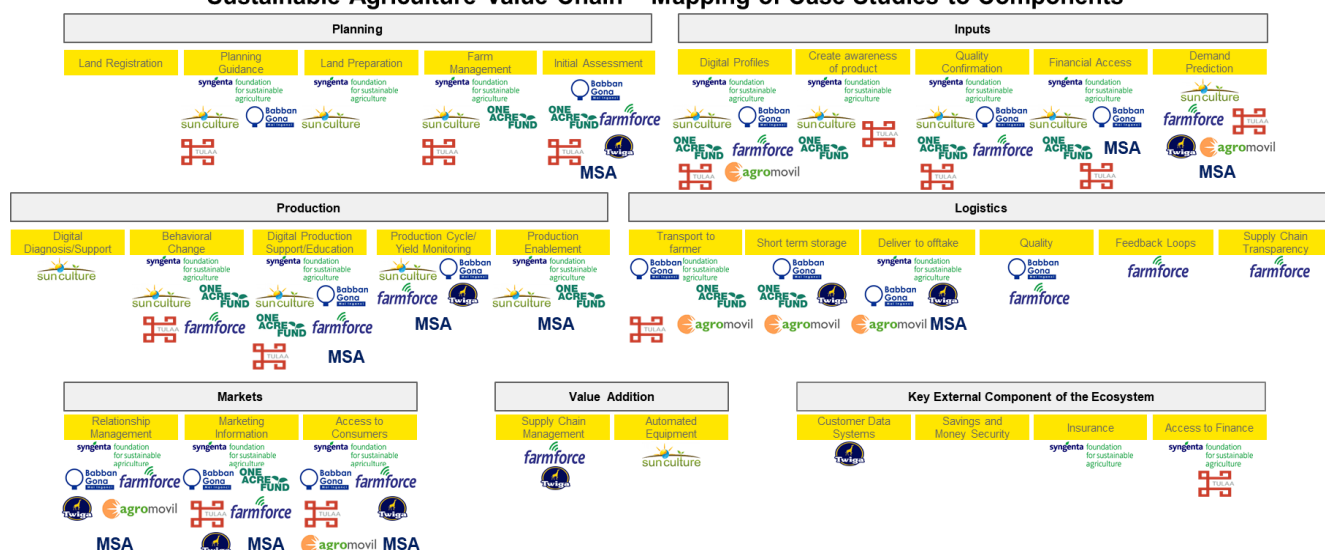
- The models used to deliver projects/programs (i.e. the architecture that facilitates the use of digital solutions)
- The digital solutions in place (or to be implemented in future)
- The agriculture value chain components that the organization addresses

The case studies provide a broad range of examples. They showcase which components of the value chain represent ‘hotspots’ of innovation and digital maturity, as mapped below. Based on the organizations studied, the most frequently served value chain components are **Inputs**, **Production**, and **Markets**. These have traditionally been focus areas in sustainable agriculture; the rise of digital innovations has facilitated their maturity. (We should bear in mind, however, that the sample size is small).

**Planning** and **Logistics** are components likely to be disrupted next by digital. In **Planning**, a plethora of digital technologies could drive better farming practices. They include Artificial Intelligence (AI) to guide planting and harvesting, as well as ‘Internet of Things’ (IoT) platforms to improve farm management. **Logistics** has already been disrupted by produce aggregation driving better storage, as well as the coordination of crop collection and delivery to buyers. There are still gaps in transportation services, as well as in technologies for greater supply chain transparency. The latter will be a key requisite for greater inclusion of SHFs in global supply chains through contract farming.

The two components least serviced by the sample organizations are **Value Addition** and **Key Ecosystem Components**. The former will be key in driving further efficiencies in the agriculture value chain. However, it will depend on the pace of innovation and normalization of technology costs. (For example, automated equipment is currently more expensive up-front than conventional machinery used in developing countries). **Key Ecosystem Components** enable SHFs to become more self-sufficient and attain financial independence, through access to services such as savings and financial products that are not simply linked to input credit/insurance.

**Sustainable Agriculture Value Chain – Mapping of Case Studies to Components**



## Syngenta Foundation for Sustainable Agriculture (SFSA)

SFSA's mission is 'to create value for resource-poor 'pre-commercial' smallholder farmers in developing countries through innovation in sustainable agriculture and the activation of value chains'. SFSA follows a pipeline approach (Innovation, Development, Scale-Up). It operates across three product streams: Agriservices, Risk Management & Financial Inclusion, and Access to Seeds.



The principle aim is to help SHFs become more commercial growers. SFSA achieves this by extending science-based know-how, facilitating access to quality inputs and finance, mitigating adoption risks, and by linking smallholders to markets in profitable ways. These activities add value to rural communities, and sustainably improve food security.

### Delivery Model(s)

SFSA offers a range of delivery models adapted to local settings. These are detailed below.

#### *Farmers' Hub*



A Farmers' Hub (FH) is an Agriservices delivery model. It provides smallholders with infrastructure, equipment, products and services, as well as information to improve production and marketing for aggregated products. FHs are typically close to transport infrastructure, but far from formal markets. Each serves at least 500 farmers in a 3-5 km radius on a franchise basis. Services include the provision of inputs, advice, training, equipment sales, machine rentals, irrigation, access to markets and financial services.

The FHs are run as franchise networks; linked into broader business networks through master franchisees. The FH initially developed in Bangladesh, is being rolled out to Indonesia, Cambodia, Kenya and Senegal.

#### *Agri-Entrepreneurs*

In India, SFSA trains and develops a network of local Agri-Entrepreneurs (AEs). Each AE works with 150-250 SHFs. AEs typically operate several business lines, for example they might sell agricultural inputs, and provide crop advice, market linkages and credit facilitation, earning commissions in each case. They coordinate harvesting schedules to ensure availability of produce for market. AEs are run as networks supported by a field force of mentors. The model is underpinned by links to credit from IDBI Bank and others. AEs act as the bank's business correspondents.

#### *CEMA Mechanization Centers*

In Senegal and Mali, CEMAs (a French acronym for *Agriculture Machinery Center*) address the lack of farm machinery. Each CEMA provides mechanized services for soil preparation and harvesting. It includes infrastructure for storing and repairing tractors, combine harvesters and other agricultural machines. The CEMAs serve farmers and local farmer organizations. Like the FH and AE models, CEMA provide enterprising young people with an additional business opportunity alongside farming.

## The Digital Component

The SFSA portfolio includes several digital solutions:

### *e-Farmers' Hub (e-Hub)*

The e-Farmers' Hub (e-Hub) helps entrepreneurs keep track of daily transactions and monitor progress in real time. The platform enables data-driven business and investment decisions, facilitating smooth FH management. The first three countries for its introduction are Bangladesh, Senegal and Kenya. The e-Hub is a smartphone app. Users can record transactions, track purchase and selling prices, and get help with inventory management. Franchise operators can access performance data across their portfolio. They can thus manage their network of franchisees efficiently, and offer help to individual FHs when required.

### *Agri-Entrepreneur Platform*

The AE Platform optimizes nine different processes, from initial selection of AEs through to their day-to-day business activities and farmer interactions. It will accelerate AE scale-up, increase transparency and improve knowledge transfer. The Platform was co-developed with Kuza Ltd, a company specializing in supporting micro-entrepreneurship and the creation and distribution of educational materials. The education platform tackles the problem of poor Wi-Fi and 3G coverage in rural areas. Each set contains a hard drive, tablet devices and portable projector. The hard drives/tablets contain three-minute videos, which are taken to villages and played to farmers. These cover a broad range of agronomy and business-building topics.

## Scale and future ambitions

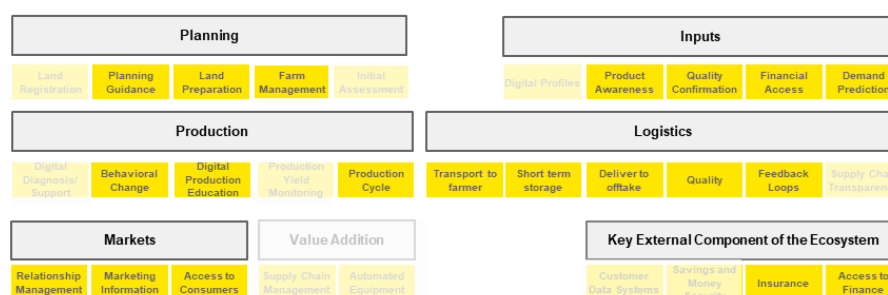
SFSA supports SHFs via a range of services available across different countries. In future, SFSA seeks to significantly scale-up the reach and impact of its solutions. As part of its approach, the Foundation adapts technologies to new environments. SFSA also aims to lead on collaborative efforts.

## Impact and how the value chain is addressed

SFSA addresses a broad range of components through a combination of digital and analogue solutions for **Planning**, **Inputs**, **Production** and **Markets**. Through the collection, aggregation and availability of key performance and market data, the digital solutions help rural entrepreneurs to manage their businesses more efficiently and be reliable partners for the larger agri-businesses with who they interact, especially in support of Logistics and supply chain efficiency. Solutions can provide updated market information, help manage the network and coordinate go-to-market activities.

Education (upskilling SHFs in better farming practices) is currently delivered primarily by analogue solutions. However, the portable educational platform used in India allows dissemination of knowledge within the value chain, directly addressing **Production issues** (mainly the improvement of farming techniques via digital channels). The CEMA model directly addresses the requirement for farming machinery, which in turn drives improved farming practices/yields.

### Sustainable Agriculture Value Chain – Components addressed by SFSA





## Case Studies

### Tulaa

Tulaa is a marketplace for SHFs in Kenya. Using mobile technology and artificial intelligence, it provides farmers with inputs on credit, and brokers the sale of their crops at harvest. The technology was incubated at Esoko, with Tulaa spun out as a company in July 2017. It is backed by investors including Acumen Fund, AHL Venture Partners, Global Partnerships and Compass Venture Capital.

### Delivery Model

The Tulaa app runs alongside a human network. For inputs on credit, Tulaa employs Business Development Officers (BDOs) who manage groups of Lead Farmers. These farmers educate others in their communities, take orders for inputs and verify basic 'KYC' (Know-Your-Customer) data for the loans. Participating 'agro-vets' (retailers) use the app to fulfill orders when the loan is approved. Tulaa has a similar structure on the market linkage side. Tulaa employees manage groups of aggregators, who source produce from farmers in their communities to fill orders on the platform.

### The Digital Component

The Tulaa application connects farmers, input suppliers and buyers. It provides the following functionality:

- Input financing facilitated through AI-driven credit scoring, repayment monitoring and notifications.
- Production forecast for the network of farmers on the app, which facilitates better access to markets/allocation of supply to buyers
- Tailored agronomy advice to SHFs, based on the inputs they have procured.

Most farmers only need to use their feature phones to engage with Tulaa. Lead Farmers, agro-vets and aggregators use the Android application.

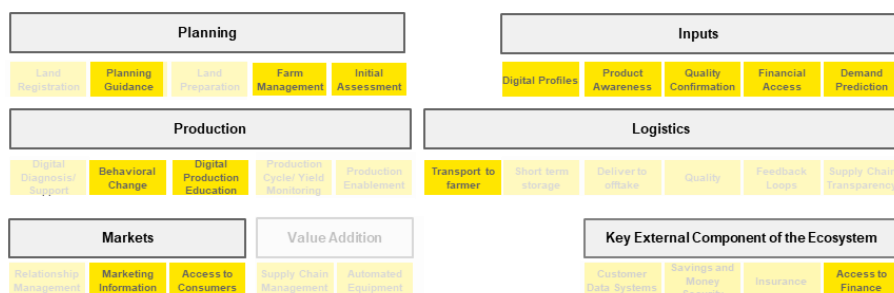
### Scale and future ambitions

In its first 18 months, Tulaa registered more than 12,000 farmers on the platform and disbursed 5000 loans. Tulaa plans on expanding within Kenya, and is recruiting more Market Linkage Officers and developing new Lead Farmers. Future ambitions include expanding into additional input-based products, and into other countries across East Africa.

### Impact and how the value chain is addressed

The biggest impact the Tulaa application has had for SHFs is credit provision for inputs. These have driven more efficient farming and transformed output for the SHFs. Tulaa is plugging the 'credit gap' faced by many African SHFs, using its innovative credit profiling approach. The Tulaa application directly addresses the **Inputs** component of the value chain. It also facilitates the **Markets** component via the aggregation and brokering functions, giving SHFs access to customers. The educational elements of Tulaa's delivery model address some of the **Production** components. Tulaa pushes agronomy advice in SMS text messages, and lead farmers instruct fellow SHFs on best practices. Harvest forecasting also falls into the **Production** category.

**Sustainable Agriculture Value Chain – Components addressed by Tulaa**



If you would like to learn more, please contact the team at [info@tulaa.io](mailto:info@tulaa.io).

## One Acre Fund

One Acre Fund (here: 1AF) follows a revenue-generating operating model, and long-term strategies to grow sustainably. Its principle focus areas are financial access, quality inputs, crop storage and training (both on farming and on go-to-market practices). 1AF aims to empower SHF communities. The practical approach it takes to risk management and farmer screening has led to a 97% repayment rate for input credit over the last five years. The micro-financing is based on a group liability model. This approach, coupled with constant efforts to drive efficiencies in the delivery model, has helped 1AF become increasingly sustainable. The organization now covers approximately 75% of its field expenses through earned revenue.

### Delivery Model

One Acre Fund runs its field operations through three layers of staff:

- Field Officer (FO) – responsible for a ‘site’ (3-7 villages, typically with 150-300 SHFs). The FO is responsible for driving registration, ordering, training and repayment. This is also supported through the appointment of a ‘lead’ farmer from each farmer group.
- Field Manager – oversees 5-6 FOs (500-1500 SHFs).
- Field Director – oversees ‘district’ operations (5000-15000 SHFs).

1AF scales its model both by increasing client density within existing districts and by expanding to new ones. The latter are chosen based on the likelihood of being able to replicate the delivery model.

### The Digital Component

For this paper we focused on two digital solutions that enhance 1AF’s customer-facing operations and streamline delivery.

#### *Field Officer Tablet Platform*

In 2018, 1AF began equipping its Field Officers with tablet devices. 10% of the 2200+ FOs received a tablet and training. The focus was on digitizing the two-part registration process, hitherto a manual, paper-based system. The tablet platform streamlined the Enrolment step and reduced errors, without affecting outcomes in the Qualification step.

In 2019, 1AF plans to give tablets to all FOs in Kenya. The platform enables further enhancement of field operations. Additional functionality will follow. This will improve training delivery, simplify the claims process for insurance products, facilitate communications between HQ and field staff, and help with logistics and transport of inputs.

#### *Interactive Mobile System*

The interactive mobile system is a two-way SMS or USSD system. SHFs use it to order seeds, fertilizer and solar devices, as well as key data such as financial balances. In Rwanda, government extension agents use mobile support to provide agronomy advice. Future functionality will probably include SHFs accessing agronomy advice and other essential services directly. The interactive mobile system has facilitated engagement with SHFs, as well as empowering them through rapid access to a range of services. Expanding self-service systems will increase confidence in 1AF’s transition of farmer payments to mobile money, further increasing operational efficiency and digital inclusion.

### Scale and future ambitions

1AF has expanded its reach year after year. In 2015, for example, it worked with some 250,000 SHFs. By 2018, this number had risen to over 800,000 across Burundi, Kenya, Malawi, Rwanda, Tanzania and Uganda. 1AF has embraced digital solutions as part of its drive to reach one million farmers by 2020.

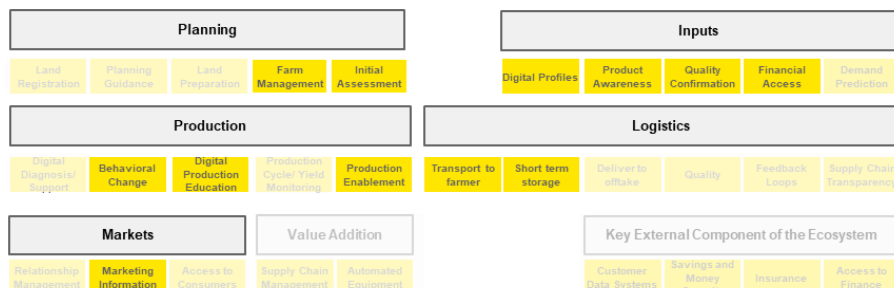
## Impact and how the value chain is addressed

As well the number of SHFs reached, 1AF use three other measures of impact and sustainability.

- Repayment rates: averaging 97% over the last four years
- % of SHF income increased: on average more than 50% over the same period
- # of staff based in rural locations: 4,300 (2015) - 8,300 (2018)

When evaluating 1AF's services along the value chain, the principle components addressed are **Inputs** and **Production**. The core focus is the provision of finance and quality inputs, as well as training SHFs on better

### Sustainable Agriculture Value Chain – Components addressed by OAF



farming practices. The offerings so far do not tend to focus on direct **Market** facilitation. However, 1AF shares market information with its SHF communities. It also provides PICS bags that enable SHFs to store crops better and therefore go to market when prices rise.

If you would like to learn more, please contact the team via [oneacrefund.org/contact-us/](https://oneacrefund.org/contact-us/)

## Babban Gona

Babban Gona was founded in Lagos in 2012. The organization believes that Nigeria must unlock its agricultural potential for economic growth, and that SHFs hold the key. Babban Gona empowers SHFs through access to inputs, credit, education/agronomy best practice and marketing services. It is now digitizing its operations to drive efficiencies.

### Delivery Model

Babban Gona has well over 100 field agents, who play a critical role throughout the season. At the start of the season they register and on-board SHFs. This entails a screening process, as well as collecting key data on the farmers and their land. These data help tailor the package of seeds, fertilizer, etc. The agents also provide agronomy training, and throughout the season monitor adherence to the guidance. On average, they visit each site twice a month. Babban Gona also facilitates go-to-market activities by providing storage solutions and aggregating produce for larger off-takers.

### The Digital Component

Babban Gona's in-house team has developed a series of tools for their field agents. An Android application has replaced the paper-based registration and screening process. This has saved about \$13,000 just on printing, reduced the potential for recruitment fraud and allows each field agent to on-board over 300 farmers per season. Another innovative application is the field mapping solution. This, too, has replaced a manual process that relied heavily on expensive physical mapping of each farm site. The new solution is 99% accurate (to 0.01 HA). A further Babban Gona application aids field agents in their monitoring role. It facilitates recording of data throughout the season and allows rapid detection of issues. This in turn makes it easier to show farmers the key drivers of increased yield.

The registration/screening and field mapping application ensure that input packages are appropriate for each SHF. This helps accurate credit calculation. Among other benefits, these applications therefore contribute to SHF groups repaying a remarkable 99.99% of the 16,000 Babban Gona loans so far.

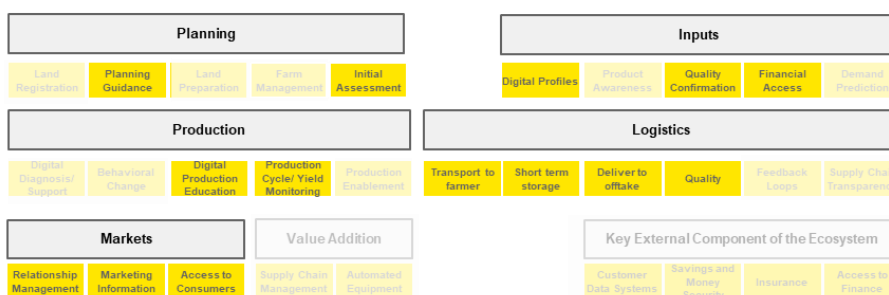
### Scale and future ambitions

So far, about 50,000 SHFs have received an input package and associated credit. Babban Gona seeks to treble this number by the end of 2019. The aim is to reach 1,000,000 farmers across Africa by 2025.

### Impact and how the value chain is addressed

The initial focus on screening SHFs and tailoring input packages sets SHFs up for success. Combined with monitoring and production guidance throughout the season, this leads to a sustainable model.

#### Sustainable Agriculture Value Chain – Components addressed by Babban Gona



These elements directly address value chain **Planning**, **Inputs** and **Production**. The focus on aggregating and storing produce and facilitating access to larger off-takers addresses the **Logistics** and **Markets** components. This holistic approach has led to significant gains for SHFs across the Babban Gona network: yields have doubled and income trebled.

If you would like to learn more, please contact the team via [info@babbangona.com](mailto:info@babbangona.com)

## Farmforce

Farmforce is a software solution that makes it easier to run contract farming with SHFs, and provides the full traceability demanded by supermarket chains and others. Farmforce was ‘incubated’ by the Syngenta Foundation, and has been in operation for seven years. In August 2017, SFSA transferred the service to an external company. This has facilitated growth and the expansion of functionality to serve a range of markets. Farmforce now has six major hubs across Europe, Africa, Central and South America and Asia. The service is available in 14 languages.

### Delivery Model

The target clients for Farmforce are organizations buying produce from large number of smallholders. To ensure that the platform provides the right functionality, a detailed requirement-gathering exercise is conducted with each new client. The solution is customizable, but most clients use the ‘off-the-shelf’ version which has been expanded and improved thanks to feedback over the past seven years. Following configuration of the platform, field agents/aggregators and client staff undergo training. This enables them to manage the solution and their contract farmers.

### The Digital Component

The Farmforce solution enables transparency and digital management of the ‘first mile’. This makes it much easier for exporters/MNCs to do business with SHFs. The farmers can thus earn better incomes. The key attribute is transparency, which allows buyers to comply with global food standards and keep a close eye on factors such as locations, seed sourcing, planting volumes, crop health, production forecasts and use of



chemicals. Farmforce further enhances supply chain management through an internal control system (calibrated with chemical/input requirements to monitor adherence), SMS functionality (to enable two-way communication with SHFs), workforce management capabilities (such as monitoring of SHF training and field staff data entry), visibility of KPIs and progress against production targets.

The digital solution has two platforms. The mobile app platform (Android) works offline/online; it is for the field agents/aggregators who engage with SHFs. They register the farmers, monitor production, and capture key data. The web platform additionally provides analytics tools to better monitor performance and compliance.

### Scale and future ambitions

Over 350,000 SHFs in more than 30 countries are registered and managed on Farmforce. Further growth is planned, for example in the following areas:

**Breweries.** Farmforce offers supply chain transparency from farmer to consumer. It enables breweries that source from Africa, Asia and LATAM to manage their outgrower schemes better. Farmforce also helps meet additional traceability requirements for brewers’ raw materials.

**Government.** Farmforce can facilitate more efficient allocation of produce. Registration with GPS mapping enables governments to know where farmers are located, what they are growing, and how the crops are progressing. Better visibility of production can help governments improve food security nationwide.



**Financial institutions.** Transactional and production data collected in Farmforce can also generate more accurate SHF credit profiles. Pilot schemes are in operation with buyers and the financial sector.

## Impact and how the value chain is addressed

Farmforce was created to help SHFs gain access to formal markets via outgrower schemes. It is transformative in that it uses mobile technology to make traceability and compliance an integral part of SHF production, thus redefining the relationship between SHFs, aggregators and buyers.

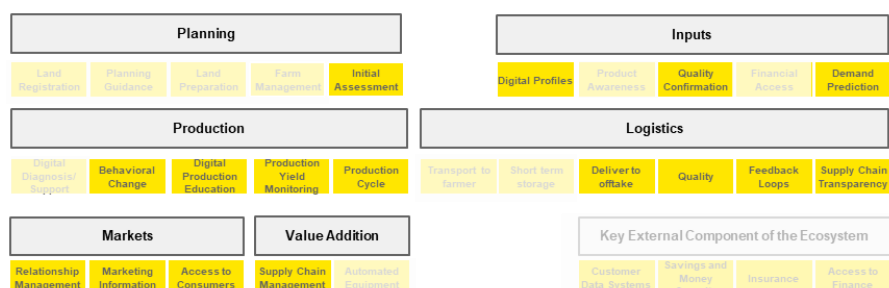
Farmforce addresses a wide section of the value chain, notably **Production**, **Logistics** and **Markets**. In **Production**, it supports compliance with food standards, and provides clarity on production performance. It can also

push reminders to SHFs to adhere to timelines and guidelines throughout the season. Farmforce is particularly strong in **Logistics**, enabling aggregation and coordination of produce, as well as monitoring and quality assurance. It also benefits SHFs by providing greater access to **Markets** through formalizing relationships with buyers and laying a foundation for contract farming.

Further information on impact should soon be available on the new version of the Farmforce website currently in preparation (May 2019).

If you would like to learn more, please contact the team via [info@farmforce.com](mailto:info@farmforce.com).

### Sustainable Agriculture Value Chain – Components addressed by Farmforce



## Twiga

Twiga facilitates access to markets for SHFs, through a platform for an efficient, fair, transparent and formal marketplace. It sources quality produce from thousands of SHFs across Kenya, and delivers to thousands of Nairobi-based vendors. Founded in 2014, Twiga has grown from dispatching one ton of produce per day to about 120. It sources ten products; potatoes and bananas make up 80% of sales volumes.

### Delivery Model

The Twiga value chain starts with collection of produce from SHFs. 'Scouts' identify and link SHFs to the Twiga network; recruitment is based on demand projections. Aggregated produce goes to the nearest of 15 Collection Centers across Kenya. It then moves to the Pack House, a huge warehousing facility in Nairobi. Orders go from there to one of five Depots. Sales reps then transport the produce to their customers.

### The Digital Component

Twiga's Data Management System (DMS) streamlines operations, and aggregates demand and supply across 13,000 farmers and 7000 customers. The DMS platform is hosted on Android devices and has three core functions:

**Processing** - drives inventory management and fulfillment at the Pack House in Nairobi.

**Sourcing** - helps onboard SHFs, as well as coordinating and aggregating harvesting to match supply with demand.

**Sales** - used by the sales force to onboard customers and for order placement.

Twiga uses its sales data to predict demand. The result drives its 'scouting' activities to ensure adequate supply.

### Scale and future ambitions

Twiga is growing fast, from 8,000 SHFs in 2018 to over 13,000 at present. It has also grown from 5000 customers to just over 7000, mainly 'Mama Mboga' stores in Nairobi. Twiga seeks to continue growing its network of SHFs and its customer base. It plans to enable customers to order directly on the DMS. It is considering expanding into another Kenyan city, with aspirations to replicate the model in another country later. Twiga also aims to focus on driving traceability across its supply chain and upskilling SHFs in more efficient and secure growing practices.

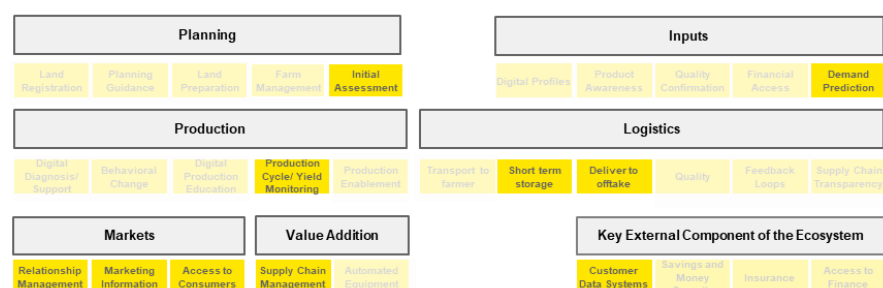
### Impact and how the value chain is addressed

Twiga focuses on the **Logistics** and **Markets** components of the value chain. It gives SHFs market access by facilitating aggregation and allocation of production across 7000 customers. SHFs across Kenya can access the

platform and markets, supported underpinned by transportation, Collection Centers, the Pack House and Depots. The DMS enables logistics coordination and plays a vital role across Twiga operations.

If you would like to learn more, please contact the team via [info@twiga.ke](mailto:info@twiga.ke)

#### Sustainable Agriculture Value Chain – Components addressed by Twiga



## SunCulture

SunCulture's mission is to develop and commercialize life-changing technology for SHFs. The organization deploys smart energy management systems and appliances, with solar irrigation as its flagship offering. The company is headquartered in Nairobi. The workforce of 101 includes 27 field sales agents in Kenya, Uganda and Zambia. SunCulture is also piloting business in other countries. It was the first company in Africa to commercialize solar irrigation. At present, only about 6% of cultivated land in Sub-Saharan Africa is irrigated, chiefly in larger farm operations. Suitable irrigation solutions for SHFs help them to increase yields significantly.

### Delivery Model

Once a prospective SHF client is identified, a field agent surveys the land. He or she sends appropriate product specifications to the head office, where the order is fulfilled. The field agent installs the irrigation system and any additional items required. SunCulture provides after-sales support via SMS, WhatsApp and phone. Its 'Pay-As-You-Grow' (PAYG) program enables farmers to repay the irrigation costs over 30 months.

### The Digital Component

SunCulture's leading product is RainMaker2, a smart solar-powered kit for precision irrigation. The company's new IoT platform links RainMaker2 with technologies such as the company's AgOptimized soil sensors and with weather stations. Advanced machine learning algorithms enable SunCulture to predict trends, optimize equipment performance and offer tailored agronomy advice via SMS. SHFs can therefore adjust irrigation and fertilizer application to optimize production.

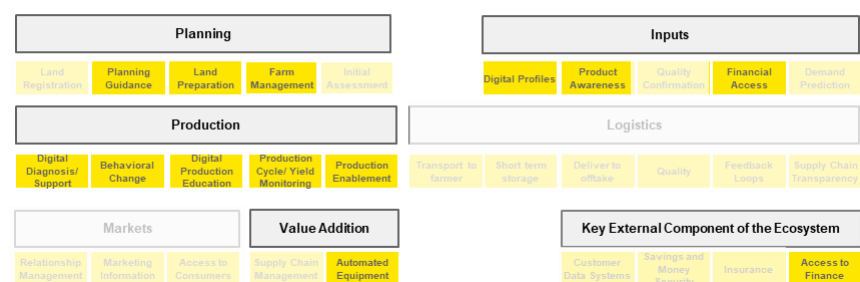
### Scale and future ambitions

SunCulture hopes to continue expanding across Africa, and into other continents. The organization also wants its IoT platform to offer more precise guidance and greater automation, enabling SHFs to farm better and save costs. SunCulture additionally intends to use its collected data for credit profiling. Many SHFs so far lack formal credit histories, because they work primarily in informal economies. With profiles based on farming results and forecasted production, SHFs would be better able to access finance and insurance products from formal institutions.

### Impact and how the value chain is addressed

SunCulture's solar-powered irrigation and related technologies enable SHFs to venture into precision-farming. This increases yields (by up to 300% in some cases) and significantly reduces water usage (c. 80%). SunCulture's IoT

**Sustainable Agriculture Value Chain – Components addressed by SunCulture**



platform has the potential to streamline and optimize SHFs' daily operations. The principle component of the value chain addressed by the SunCulture portfolio is **Production**, through the provision of automated farming equipment (irrigation systems, soil sensors) and its production monitoring capabilities (facilitated by the IoT platform). The **Inputs** component is also addressed through the digitizing of SHF profiles and recording of farming data, as well as the PAYG credit program. The **Value Addition** component is addressed through greater automation.

If you would like to learn more, please contact Samir Ibrahim ([samir@sunculture.com](mailto:samir@sunculture.com)).

## MSA (Multiservices Agricoles Sarl)

MSA was founded in 2015 in northern Senegal. It has a farm machinery center, and provides mechanized and digital services to farmers, rice mills and buyers. MSA focuses on the rice value chain.

### Delivery Model

MSA is developing a delivery model in which it aggregates paddy production, and links up with mills and their customers. MSA agents advise farmers on good agricultural practices including better use of inputs. These agents are often SHF cooperative members who receive MSA training.

### The Digital Component

The Remugol application seeks to facilitate MSA operations by better connecting key players across the rice value chain. It brings together farmers, mills, buyers and banks/lenders. Key Remugol functionality includes:

- Production forecast data for the mills (based on farmer entries into the application), which allow MSA to aggregate demand and allocate production.
- Facilitation of financing/credit for the SHFs, who can contract with the mills, receive payment ahead of harvest to help cover production costs, and access loans.
- Financing repayment (with the paddy rice), and sale of surplus production via the platform.
- Support for the mills in selling white rice to a broader range of buyers.
- Performance reporting for each farmers, mills and traders, facilitating traceability
  - SHF production and sales activities
  - Input sourcing (paddy rice), production metrics and sales volumes for the mills
  - Rice supply for distributors.

### Scale and future ambitions

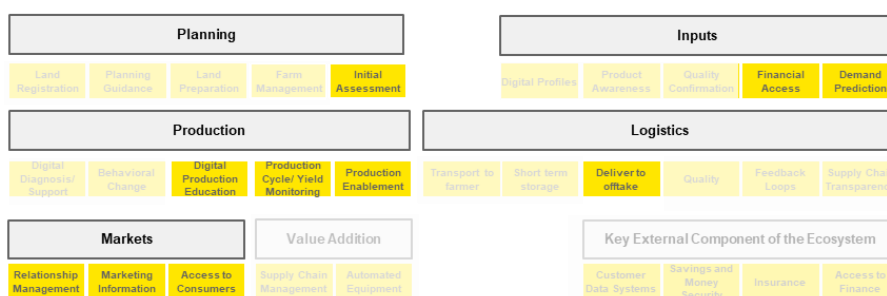
There are currently 800 SHFs on the platform, following launch of the ‘off-line’ version in 2018. MSA intends to grows to 7000 farmers this year, and raise the number of agents to 25. The ambition in two to three years is to expand into neighboring countries and other cereal value chains.

### Impact and how the value chain is addressed

Remugol plays a key role in facilitating the aggregation of produce and access to markets for SHFs. The wider MSA program also facilitates SHF financing by brokering loans between the rice mills and the SHFs

who supply them. The core value chain components addressed are therefore **Inputs** and **Markets**. The MSA agents also help SHFs with an application called RiceAdvice, developed by Africa Rice with support from the Syngenta Foundation ([www.riceadvice.info/en/](http://www.riceadvice.info/en/)). The tool provides guidance on subjects such as fertilizer use, and has led to production increases of 0.5-1 tons per hectare. This service, in combination with the monitoring functionality of Remugol, means that the wider MSA program also addresses the **Production** component.

**Sustainable Agriculture Value Chain – Components addressed by MSA**



If you would like to learn more, please contact [www.linkedin.com/in/mouhamadou-mor-beye-090a7584/?originalSubdomain=sn](https://www.linkedin.com/in/mouhamadou-mor-beye-090a7584/?originalSubdomain=sn)

## Agromovil

Agromovil seeks to facilitate logistics throughout the value chain. It uses its platform to ‘Match, Batch and Pay’ for transport of produce to markets, reducing the need for intermediaries. Based in Washington, D.C., Agromovil was founded in 2016, as a spin-off from AMGlobal Consultants. Following beta-testing in 2018, it is piloting the platform in Labrija, Colombia, where it plans on enrolling some 150 farmers.

### Delivery Model

The ‘Match’ (SHFs/sellers and markets/buyers), ‘Batch’ (consolidating a large number of transactions/deliveries/pickups) and ‘Pay’ (via mobile money) model seeks to empower SHFs by facilitating their go-to-market activities. The ‘Match’ function allows SHFs greater control of how they get their produce to market. (Conventionally, they are forced to accept a dealer’s price due to lack of other options). The ‘Batch’ function significantly reduces the costs. ‘Pay’ aims to reduce fraud and formalize the logistics process.

For the pilot, Agromovil plans to work with cooperatives and identify lead farmers to help train SHFs on using the platform. Agromovil will also familiarize local businesses and then larger aggregators with the application.

### The Digital Component

The Agromovil application will work on Android devices. Users (sellers, transporters, buyers) can ‘Match, Batch and Pay’ directly on the app. Transport demand is calculated by combining produce volumes ready for market and buyers’ demand.

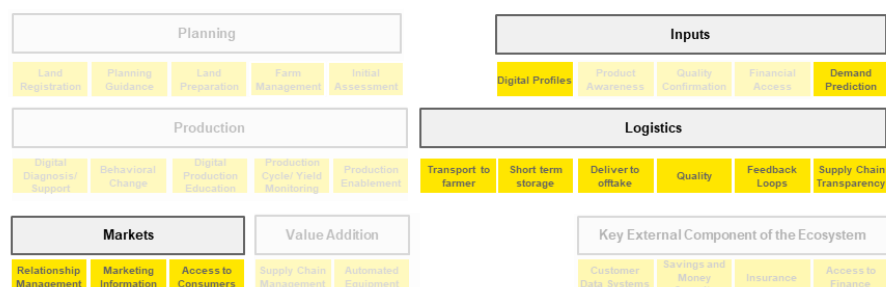
### Scale and future ambitions

The initial focus for Agromovil is to pilot its platform and then expand within Colombia, developing a network of SHFs, buyers, markets and transporters. Additionally, Agromovil seeks to develop a circular system in which transporters also deliver farm inputs and other goods to rural communities, rather than only taking produce from farmers to markets. As the platform matures, Agromovil has ambitions to expand its reach across Latin America, Africa and Asia.

### Impact and how the value chain is addressed

By driving efficiency in the **Logistics** component of the value chain, the Agromovil platform seeks to reduce the c.30% of food production that does not make it to consumers/markets. Better coordination of supply and demand should also significantly reduce the number of intermediaries between farmer and consumer (currently about ten). Additionally, by linking sellers and buyers on the same platform it seeks to improve SHF access to **Markets** and give farmers greater control. Agromovil also seeks to improve the situation for female SHFs, who traditionally do not arrange transport. The application gives women more direct access to transporters.

**Sustainable Agriculture Value Chain – Components addressed by Agromovil**



If you would like to learn more, please contact the team via [executiveassistant@amglobal.com](mailto:executiveassistant@amglobal.com)



## **Keys to successful deployment of digital solutions in sustainable agriculture**

As the case studies show, digital solutions are transforming smallholder agriculture. The digital revolution provides an extraordinary opportunity to address one of humanity's biggest challenges: feeding an ever-growing global population, whilst at the same time lifting hundreds of millions of people out of poverty. To embrace this opportunity, it is important to consider some key aspects and success factors.

### **'Digital' is an enabler – not an end in itself**



One key lesson from the case studies highlights the importance of seeing digital solutions as enablers to sustainable agriculture. They can connect key players across the value chain and facilitate scale-up across regions. The ability to reach a broader population of stakeholders through mobile technologies significantly reduces the costs normally associated with outreach endeavors. However, in all the examples of successful digital solutions, a key precept is to set up the right delivery models, i.e. the methods by which organizations engage with and support SHFs. These models must be tailored to specific regions and must take cultural and technical aspects into account. They include the level of mobile data use, 'digital literacy', infrastructure, transportation routes, market maturity and crop types. These are just a few of the many factors to be considered.

Digital enablers, however, also require enablement themselves. Wherever possible, governments should support agricultural transformation by

providing the right infrastructure and policy frameworks. For example, they can drive the establishment of reliable connectivity and robust transport networks. Private and non-profit entities can use such investments to develop and implement digital solutions that are commercially viable, and beneficial to smallholders.

### **Empower the 'field force'**

The key to successful delivery is an empowered and motivated field force. This 'force' comes in several forms, including agri-entrepreneurs, field officers, agents and aggregators. The field force is frequently the gateway between innovative organizations (and their solutions), markets, and SHFs.

The digital revolution is in full flow, but, given the still low adoption of smartphones, lack of bandwidth, and limited digital literacy, widespread direct SHF access to digital solutions is still some way off. This paper's authors believe that it will be at least another 3-5 years before the majority of the global SHF community has reliable and useful direct access to mobile/tablet technology and connectivity. For now, the field force needs to remain an essential actor in disseminating and embedding digital solutions, driving transformation across sustainable agriculture.

An example of empowering the field force is the One Acre Fund strategy of enhancing the effectiveness of its over 2,200 Kenyan field officers by giving them all tablet devices. Digitizing of the registration process (just the first function of many planned for the tablet platform) will streamline operations, reduce errors and on-board SHFs much faster. Officers can therefore focus on other value-adding endeavors such as improving farming practices, distributing inputs and coordinating go-to-market activities.

## Address the entire value chain

Conventional attempts to solve agricultural challenges have typically focused on specific components of the value chain (e.g. *Production*, *Transportation* or *Markets*). This paper argues that a broad, holistic approach needs to be taken to drive greater value and impact for SHFs. Digital solutions provide an opportunity to combine innovations that go beyond traditional approaches. Providers of different services can bundle offerings and service a wider pool of customers. With greater access to mobile technologies, a broader range of ‘players’ (farmers, aggregators, suppliers, financial institutes, etc.) can benefit. Value chains become more efficient as a result. For example, the Tulaa platform presented above has integrated the M-Pesa mobile money system into its platform. This makes it much easier for SHFs to buy inputs and receive payment for produce.

## Ensure wide collaboration and good governance

This paper advocates a broad approach to addressing agriculture value chain challenges. However, it does not propose that organizations seek to develop their own end-to-end solutions in isolation. Organizations need to collaborate. Collaboration can take several forms. One option is integration of complementary solutions that together address the broader value chain – a ‘gateway of services’ on a single platform. Agents can access this platform and tailor its output to the needs of each SHF/cooperative. Numerous such platforms are already available, but there is scope for many more.



Another example of collaboration is the use of different networks and delivery models to incubate solutions and scale them up faster. Good linkages between service providers (financial institutions, input suppliers, etc.), technology organizations and the agricultural are essential here.

Similarly minded organizations should share know-how, lessons and resources in order to co-develop solutions. Committees, focus groups and recognized standards help advance digital solutions. For example, the Digital Impact Alliance (DIAL) spans the public, private and non-profit sectors. It seeks to unlock markets to deliver digital services and data across the developing world. It collaborates with digital providers to address scalability challenges, whilst also providing guidance on subjects such as data use/protection and deployment strategies.

Smooth introduction of digital solutions also requires installation of the right governance structures. For example, digitized land titles for SHFs could improve protection of ownership. However, they also make land easier to trade, potentially leading to exploitation of cash-strapped SHFs. Another example of potential disruption needing careful handling is streamlining of the ‘farm to fork’ food chain by organizations such as Twiga. What is good news for SHFs and consumers may leave large numbers of today’s intermediaries without a livelihood. Digital solutions can have very positively ‘disruptive’ effects, but good governance, standards and controls, as well as support for the digitally disrupted ‘losers’, are required to minimize any negative aspects. This is as true in agriculture as it is in other sectors.

## Strengthen the agricultural financial market

In developing countries, only about 25% of SHFs' and small agricultural companies' demand for finance is actually serviced. When they *are* provided, credit and insurance are often restricted, and products are not tailored to local needs. Lack of finance limits opportunities for SHFs to escape poverty, perpetuates inefficiencies and stifles innovation <sup>[5]</sup>.

Digital solutions can help improve this market. 'Big Data' can be harnessed to develop more efficient loan profiling. In the absence of standard credit histories for SHFs, data on production, demand, weather and other factors can help banks decide efficiently whether to provide credit. Furthermore, digital tools can reduce the significant challenge of servicing remote rural areas, empowering more SHFs and potentially increasing healthy competition in the credit market.

To mature the financing market across agriculture in the developing world, public, private and non-profit entities must all play their respective parts.

Public bodies must provide the right environment by ensuring that appropriate regulation and market incentives are in place to entice and support private financial organizations. Some governments, such as that of Rwanda, are rising to the challenge.



Private enterprises also play a critical role. They can both develop tailored credit and insurance products, and build on existing digital innovations to further reduce barriers to servicing remote customers. Non-profit organizations should continue to play a critical role in helping incubate solutions. They can both facilitate innovation and provide access to SHF networks that require relevant services/solutions. For example, TechnoServe partnered with Vodafone and USAID as part of the Connected Farmer Alliance <sup>[6]</sup>. Together they promoted

commercially sustainable mobile agriculture solutions. These increased the productivity and revenues of 500,000 SHFs across Kenya, Tanzania and Mozambique. TechnoServe supported the scale-up of mobile money services for farmers, including savings and credit. Such services help smallholders accumulate assets and increase resilience. They also supported the development of sustainable business models that prove the commercial viability of mobile solutions for SHFs, thus driving greater investment in the field.

[5] USAID & CSAF: "CSAF financial benchmarking Final learning report", 2018.

[6] [www.technoserve.org/our-work/projects/connected-farmer-alliance](http://www.technoserve.org/our-work/projects/connected-farmer-alliance), retrieved 20 May 2019



## **Establish the right business models to drive digital solutions**

Another key question for organizations entering or already active in this area is how to monetize the value created. How will revenue be generated once the solution has been deployed? Will it be enough to drive growth? Who will pay for this solution? When and where do the opportunities to charge arise?

To answer these questions, the right business model must be in place or planned for. One example of how organizations are generating revenue through their digital solutions is through the bundling of services. For example, the digital solution(s) may act as the ‘anchor’ product that allows for revenue generation from accompanying services. The ‘anchor’ solution could also be used to drive revenue from a broader range of value chain players. For example, a credit-focused solution could charge input suppliers and financial institutions for access to a platform which gives them access to new SHF customers. Another example is the ‘freemium’ model: a basic version of the solution is available free, but additional features attract a premium subscription. SHF demand could be stimulated by showing valuable results.



## **Commercial viability is the key to impact**

Agricultural solutions for pre-commercial SHFs have traditionally been developed and delivered by the public and non-profit sectors. However, an ever-growing number of private commercial organizations are entering this field. Examples include technology organizations, financial institutions and multi-nationals. Their motivations differ from those of more traditional players, and their involvement has promoted innovation, notably in digitizing of the value chain. The right standards and governance must be in place to maximize the benefits of private sector engagement for both agri-entrepreneurs and SHFs. Commercial viability is needed to drive sustainable impact and scaling up of entrepreneurial solutions.

Farmforce is an excellent example of how commercial forces have facilitated scale-up. The Syngenta Foundation incubated this solution for five years before spinning it off to a company with proven experience in the appropriate field. Moving from a non-profit organization to full commercial operation facilitated growth and the expansion of functionality, to better serve a broader range of customers.

## **Identify the right environments to deploy digital solutions**

As in all commercial ventures, an important step to success is understanding the demand for services / products / solutions, and the overall operating environment. In the case of digital solutions in sustainable agriculture, there are numerous factors to consider. Here are a few examples:

- Market size – number of SHFs, acreage of farmland, prevalent crop types
- Market conditions – gaps, competition
- Complementary/enabling market players – who are potential partners?
- Physical environments – weather conditions are stable/cyclical, infrastructure facilitates logistics and/or engagement with SHF communities
- Political environments – stability of government, political agendas, prioritization of agriculture (is it a key policy area?)
- Technology penetration – how many of the intended beneficiaries have access to mobile/3G devices?

## **Moving forward - driving the digital agenda in sustainable agriculture**

This paper showcases the potential for digital solutions to have significant positive impact on sustainable agriculture for smallholder farmers. It also provides a framework through which organizations can evaluate their offerings, facilitate planning and avoid pitfalls. Organizations need to focus on cost, impact and scale, and assess solutions' usefulness across the entire value chain.

This paper also sets out key considerations when deploying digital solutions. These tools must be an enabler for sustainable agriculture, empowering the half a billion SHFs who are the engine of farm productivity across the developing world. Digital solutions address what, for example, Syngenta calls the 'five A's' of improving SHF livelihoods; **A**ggregation to keep costs down and attract large buyers, **A**wareness of improved farming practices, **A**vailability and **A**ffordability of inputs, and **A**ccess to markets.

Advancing innovation requires a mix of competition and collaboration, or 'co-opetition'. This means the harnessing of multiple players' knowledge, experience, data and ideas to advance the common goal of scaling up solutions for smallholders, while allowing competitive forces to encourage individual organizations to out-perform. An example of 'co-opetition' is the Council on Smallholder Agricultural Finance, an international alliance of twelve leading providers. They meet regularly to benchmark performance, learn from each other, as well as define shared needs to communicate to investors and funders. Their efforts have already improved clarity, sophistication, product innovation and capital efficiency. There are many more examples across agriculture.

This paper aims to excite players across and outside the agriculture value chain by showing that 'digital' is transforming the sector. The solutions, impact, challenges, themes and organizations featured in this paper set the context for impact entrepreneurs/organizations to continue to drive transformation, in one of the world's most critical industries.