



Final report

Report Title: Digital harvest

**Client: Alliance for a Green Revolution in Africa
(AGRA)**

Consultant: Advantech Consulting Limited

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Report authors

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Acronyms and Abbreviations

AGRA	Alliance for a Green Revolution in Africa
API	Application Program Interface (set of coding to build software & apps)
ATL	Above-The-Line (mass marketing like radio and internet)
ATP	Ability to pay
B2B	Business-to-Business
B2C	Business-to-Consumer
BTL	Below-The-Line (one-to-one marketing like samples and brochures)
CEO	Chief Executive Officer
CTO	Chief Technology Officer
FAO	Food and Agriculture Organization
FBO	Farmer Based Organization
FISFAP	Financial Inclusion for Smallholder Farmers in Africa Project
FML	Faida Market Link
FRI	Farm Radio International
IBUTTI	International Business and Trade Tanzania Initiative
ICT	Information and Communications Technology
IFDC	International Fertilizer Development Center
ISFM	Integrated Soil Fertility Management
IVR	Interactive voice response (e.g.: 'press 1 for English')
KII	Key informant interview
KPI	Key Performance Indicators
M&E	Monitoring and Evaluation
MIS	Management Information System
MNOs	Mobile Network Operators
MoU	Memorandum of Understanding
NDA	Non-Disclosure Agreement
NGO	Non-Governmental Organization
OBD	Outbound voice dialling
R&D	Research and Development
RATIN	Regional Agricultural Trade Intelligence Network
RFP	Request for Proposal

SHFs	Smallholder Farmers
SMS	Short Message Service
TOR	Terms of reference
USAID	United States Agency for International Development
USSD	Unstructured Supplementary Service Data (e.g. *522#)
VAS	Value - Added Service
VCA	Value Chain Actors
WTP	Willingness to pay
IP	Intellectual property

Executive Summary

How to Grow and Sustain the Digital Harvest?²

Why is AGRA interested in this question?

The development of digital solutions that assist farmers in improving their yield and incomes from agriculture has been booming since most farmers in Ghana, Kenya and Tanzania have mobile phones. The Digital Harvest of these 150+ so-called ICT4Ag solutions provide farmers with information on market prices, good agronomical practices and weather or offer supply chain management services like transport and produce aggregation. These non-financial agricultural services are instrumental in de-risking financial services delivery. A farmer who knows how to apply fertilisers and where to sell the harvest for a good price is more likely to be able to pay back an input loan. However, within the Digital Harvest there are already signs of post-harvest losses: some solutions disappeared from the market due to flaws in their business models. Hence, AGRA's interest in understanding which ICT4Ag solutions are sustainable and valued by farmers, so that only the scalable and sustainable solutions are supported. Earlier research by GSMA, CTA and Mercy Corps³ concluded that flawed business models are a main cause of underperforming solutions. Reason why AGRA mandated an assessment of the business models of fifteen solution providers across Kenya, Tanzania and Ghana. As the sample is small (<10%) we do not claim that the review is representative of the universe of ICT4 Ag solutions, however it does yield insights in flaws and possible improvements to grow and sustain the solutions that propose real value to its users and clients.

What do sustainable ICT4Ag solutions look like?

The business model review found that five out of fifteen solution providers were sustainably delivering (some) services. User numbers vary between 5,000 and 350,000 users. In the graph below it can be seen that there is no clear relation between sustainability and business model, type of services or user numbers. The longer the solution providers are in existence the more likely it is that they are sustainable. An explanation might be that solutions that do not break even after 5 years stop operating.

² This brief has been prepared by Hedwig Siewertsen from AGRA. The assessment was conducted by Joseph Waruingi and Erick Muriithi from Advantech Consultants Ltd. in Kenya. Further reading on www.raflearninglab.org and www.agra.org

³ - Lessons for Sustainability: Failing to Scale ICT4Ag-enabled services, CTA, 2016
- ICT based solutions for Value Added Services, MercyCorps AgriFin Accelerator, 2016
- Agricultural Value Added Services (Agri VAS): Market Opportunity and emerging business models, GSMA, 2015



The successful solution providers:

1. Have revenue models where agri-businesses or (governmental) institutions pay for smallholder farmers to access the services: hence the (paying) client differs from the user;
2. Combine (cheap) digital delivery channels with (expensive) face-to-face promotion and marketing to gain trust from smallholder farmers and organise regular customer feedback;
3. Offer a combination of valued and focused services in partnership with (trusted) organisations that give access to content, users or infrastructure
4. Have copy-right protected technology and (financial) key performance indicators to monitor the business
5. Have diversified sources of income: subscription and usage fees combined with advertisements and commissions. The selling of data collected through the solution is often mentioned as a revenue stream but it is too early to see success cases of this potential revenue stream.

The picture below summarises the findings for each segment of the business model canvas used for the assessment. The weakest areas of the business models of the collective 15 solution providers were found to be customer segmentation, customer relationship, cost structure and revenue model.

Key Partners  <ul style="list-style-type: none"> • Agribusinesses • Donors • NGOs • Governments • Mobile Network Operators • Content providers 	Key Activities  <ul style="list-style-type: none"> • IT development • Marketing • Content development 	Value Proposition  <ul style="list-style-type: none"> • Information services (weather, market prices, agronomic practices) • Extension and advisory (tailor-made by experts) • Trading platform (buying and selling of inputs and produce) • Supply chain mgt. (aggregation and transport) 	Customer Relationships  <ul style="list-style-type: none"> • High % inactivity • Few feedback loops • Face-to-face and radio most used 	Customer Segments  <ul style="list-style-type: none"> • Customer segmentation and market research in most cases not undertaken. • No user centered design in most cases • Illiteracy, language, tech-savviness, phone type, age, gender, are all relevant
Cost Structure  <ul style="list-style-type: none"> • Largest cost item is staff and marketing • Very little cost consciousness (on cost of customer acquisition, break even point, efficiency and sustainability indicators) 		Revenue Streams  <ul style="list-style-type: none"> • Subscription fee (once, monthly, annual) • User fee (per click or message revenue share with MNO) • Subsidies or government budget • Advertisement, data selling and cross selling hardly mentioned 		

What is hampering ICT4Ag solutions to grow and sustain?

1. Smallholder farmers have a low ability or willingness to pay for services; mobile network operators propose unfavourable revenue sharing models; affordable patient capital to finance scaling of solutions is hard to find; many solutions have no clear revenue model and struggle to finance their growth.
2. The limited segmentation of the customers (literacy and tech savviness), weak relationship management and limited customer feedback mechanisms, reduce users' uptake and retention.
3. Farmers mistrust or resist to innovation and technology if they feel their airtime is being used through automated payments and push messaging.
4. Extension workers and trader agents, who are the potential promoters of the solutions, might fear for their job or income when trading is automated, prices become transparent or extension messages are digitised. The need for change management at that level is often not recognised.
5. Solution providers insufficiently track financial key performance indicators as a measure for sustainability and have a limited view on their cost drivers.

These flaws in business models and lack of clear business case of clients and users, lead to solutions that do not have solid revenue models and/or that do not empower (illiterate, non-English speaking or not tech-savvy) customers to adopt the solutions.

How can ICT4Ag solutions grow towards sustainability?

ICT4Ag solutions could become more sustainable, attract more resources and have more users if:

1. A freemium revenue model is adopted and promoted by (early) users. This allows the solution to first demonstrate its value before customers will be charged;
2. A user-centred design process is adopted. This will make the content more farmer centric and the solution more user friendly; Bundling with services for which farmers have a willingness to pay (credit for example) might improve uptake. Change management support at the level of promoters and institutions adopting the solutions is key for customer acceptance.
3. Symbiotic partnerships are forged with other providers to share information gathering services (field agents), customer acquisition and feedback services (call centres) and content generation (agronomic experts) which could reduce costs of services delivery;
4. The providers organise as a group to lobby the mobile network operators for an equitable revenue share percentage and the financiers for patient affordable capital instruments;

5. A strong business case for all actors involved can be presented (target customer, promoter and content provider) and an exit strategy for donor support is envisaged.

We would like to extend our sincere gratitude to the fifteen solution providers that volunteered to share their successes and challenges in making ICT work for smallholder farmers:



1. Introduction

1.1. Background

The Alliance for a Green Revolution in Africa (AGRA, www.agra.org) is a not-for-profit organization working with African governments, other donors, NGOs, the private sector and African farmers to significantly and sustainably improve the productivity and incomes of resource poor smallholder farmers in Africa. AGRA aims to ensure that smallholder farmers have what they need to succeed: good seeds and healthy soils; access to markets, information, financing, storage and transport; and policies that provide them with comprehensive support. Through developing Africa's high-potential breadbasket areas, while also boosting farm productivity across more challenging environments, AGRA works to transform smallholder agriculture into a highly productive, efficient, sustainable and competitive system, while protecting the environment.

AGRA has been supporting agricultural transformation interventions for the past 10 years. A large share of the support was focussed on capacity building of smallholder farmers and their organisations in good agronomic practices, post-harvest handling and marketing and (financial) management. AGRA realises that access to finance for smallholders is crucial for the implementation of the acquired knowledge. FISFAP is a MasterCard Foundation funded program focussing on financial inclusion for smallholder farmers, whereby both AGRA and MCF are convinced that financial services only lead to agricultural productivity and income improvements if non-financial services are delivered along-side or as part of the financial products. With the emerging digital highway and increased use of mobile phones by smallholder farmers, the deployment of ICT in services delivery seems to be one element that can lead to sustainability.

Some key challenges in ICT based non-financial agricultural services (ICT4Ag) delivery is the low continued use of the service (smallholders subscribe but become inactive after some time) and the dependency on donor funding for sustaining the business delivering the service.

In view of addressing these challenges and sustainably delivering these embedded non-financial services to smallholders, AGRA would like to promote business models and products and services that have proven their sustained uptake and financial sustainability. This study seeks to assess the landscape and business models for ICT based agricultural non-financial services delivery in Kenya, Tanzania and Ghana in view of identifying key success factors and pitfalls to avoid in non-financial services delivery.

1.2. Purpose and objectives of the research

Earlier research by GSMA, CTA and Mercy Corps⁴ concluded that flawed business models are a main cause of underperforming ICT4Ag solutions. Reason why AGRA mandated the assessment of the business models of fifteen solution providers across Kenya, Tanzania and Ghana. As the sample is small (<10%) the review does not pretend to be representative of the universe of ICT4Ag solutions, however it does yield insights in flaws and possible improvements to grow and sustain the solutions that propose real value to its users and clients.

⁴ - Lessons for Sustainability: Failing to Scale ICT4Ag-enabled services, CTA, 2016

- ICT based solutions for Value Added Services, MercyCorps AgriFin Accelerator, 2016

- Agricultural Value Added Services (Agri VAS): Market Opportunity and emerging business models, GSMA, 2015

The objective of the study is to provide:

1. an **insight in the underlying business models** of 15 selected services delivering non-financial solutions to smallholders (information, markets, supply chain management);
2. an understanding on the **scale and depth** that services should and can realise in order to be delivered sustainably;
3. an understanding on the **business case** for each actor involved (service providers, farmers, value chain actors, financial institutions);
4. an insight in proven **incentives** that enhance sustained outreach (high % of active users and client retention) and quality of the services delivered;
5. Summarise **key success factors** and **pitfalls to avoid** in sustainable business models for agricultural non-financial services delivery

2. Methodology

Business models capture the logic of how companies do business by describing the rationale of how they create, deliver, and capture value. The assessment approach was based on a 9-component business model framework developed by Osterwalder et al, 2010. The nine components include:

i. Customer segments

It defines the different groups of people or organizations an organization aims to reach and serve. The 5 types of customer segments include:

- Mass market – No distinction between different customer segments
- Niche market – Focus is paid on specific, specialized customer segments
- Segmented – They distinguish between market segments with slightly different needs and problems
- Diversified – It serves two unrelated Customer Segments with very different needs and problems
- Multi-sided – It serves two or more interdependent Customer Segments

ii. Value Propositions

It refers to how the business benefits its target customer segments either by solving a problem or meeting a need. In this study they can be grouped into 4:

- Information solutions (agronomic, weather, market price)
- Expert advice and extension solutions (helplines, crop management and animal management)
- Supply chain management solutions (logistics, storage, transport, agro dealer stocks)
- Trading platforms (inputs, commodities, animals, equipment etc.)

iii. Channels

It outlines the interface a business uses to reach its customer segments. There are 5 channel phases: awareness, evaluation, purchase, delivery and after-sales.

iv. Customer Relationships

It defines the type of relationship the business has established with each Customer Segment to acquire new customers, retain existing customers or/ and boost sales. They can include: personal assistance, automated services, member communities, and co-creation.

v. Revenue Streams

It represents the financial value in terms of cash that a business generates from each customer segment. The stream can be categorized into 2: one-time customer payments and recurring revenues from on-going payments. ICT based agricultural solutions providers mostly generate revenues through:

- Usage fee – It is produced from the use of a particular service whereby the more a service is used, the more the customer pays
- Subscription fee - It is generated by selling continuous access to a service
- Advertising – It results from fees for advertising a particular product, service, or brand

In this study ICT4Ag solutions were grouped into 3 direct revenue models:

- Business-to-Consumer (B2C) – Revenue is generated from farmers
- Business-to-business (B2B)– derive revenue from organizations and farmers don't pay

- Hybrid – have two revenue streams - smallholder farmers and enterprise customers

vi. Key Resources

It describes the most important assets required to make a business model work. They can be physical, financial, intellectual, or human.

vii. Key Activities

They differ depending on the business model type and are the most essential actions a company must take to operate successfully e.g. software development. They can be categorized into:

- Production – The activities relating to designing, making, and delivering a product
- Problem solving – Involves developing solutions to individual client problems
- Platform/ network - Key Activities in this category relate to platform management, service provisioning, and platform promotion.

viii. Key Partnerships

It refers to the network of suppliers and partners that make the business model work. There are four different types of partnerships:

- Strategic alliances between non-competitors
- Cooperation: strategic partnerships between competitors
- Joint ventures to develop new businesses
- Buyer-supplier relationships to assure reliable supplies

They are created for different purposes such as optimization of business processes, risk reduction, and acquisition of particular resources and activities.

ix. Cost Structure

It describes the most important costs incurred to operate the business model. There are two broad categories of business model cost structures:

- Cost-driven – The business model focuses on minimizing costs wherever possible
- Value-driven – There is less concern with the cost implications and focus is instead placed on value creation

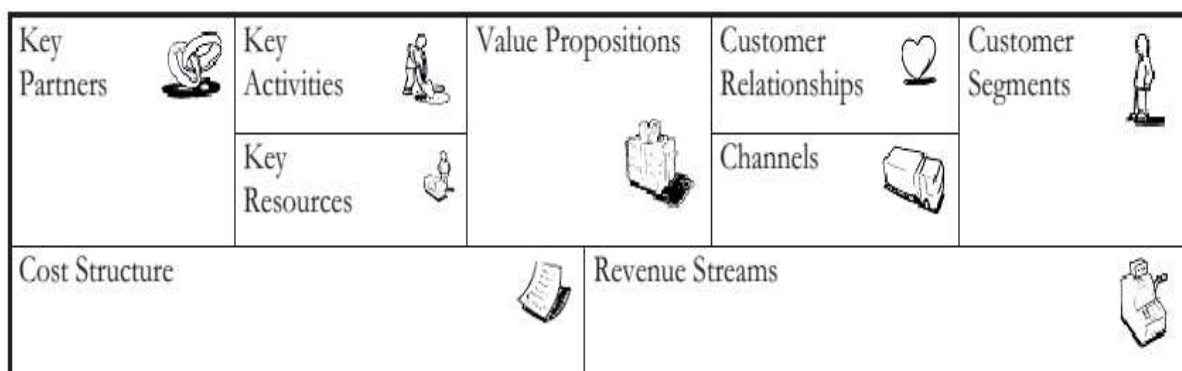


Figure 1: Business model canvas (Source: Osterwalder et al, 2010)

The outcomes of the 15 business cases were analysed through: (i) providing in-depth descriptions of the unit of analysis (ICT4Ag solutions) e.g. years of operation and range of

non-financial services being offered; (ii) developing under each of the 9 components of the business model framework common themes or patterns – looking at relations and comparisons; and (iii) comparative analysis to arrive at significant differences and similarities.

2.1. Hypotheses explaining the low uptake and (financial) unsustainability of ICT4Ag solutions

2.1.1. Low uptake

- i. Unsatisfactory or irrelevant content

Most service providers lack access to good content providers' thereby very basic level information is being provided on their platforms. The information thereby ends up not being translated into productive action by the farmers.

- ii. The advice given is difficult to follow or too complex

Some service providers use terminologies that may be considered too scientific e.g. regulate calcium levels in the soil to prevent blossom end rot disease affecting your tomato plants.

- iii. Insufficient marketing strategies to stimulate demand

This leads to low level of awareness about the new/ existing services and how they are accessed.

- iv. Illiteracy and low technical literacy of target population

- v. Language barriers

Factored by the lack of literacy skills, most farmers are usually comfortable with the services being offered in the local languages.

- vi. Lack of access to compatible mobile sets

This mostly affects the service providers who rely on mobile applications as their delivery mechanisms.

- vii. Advisory services are less/ not personalized according to farmer profiles

Most times there exists a huge disconnect between the services provided and the information needs of the farmers they target. The generalized information provided without taking into account the requirements of the farmers is therefore not actionable, timely or complete.

- viii. No built-in mechanism to gauge customer satisfaction

Most providers have no method to assess customer satisfaction, dissatisfaction and loyalty with regards to the services they provide.

- ix. Service design that is not user friendly

This hinders navigation and increases the number of time-outs especially for USSD and IVR channels

- x. Some services are also limited to one mobile operator

This locks out the customer base subscribed to different networks.

- xi. Target population's mind set towards mobile phones as a source of information

A majority of the farmers use their phones solely for calls and texts therefore making them an unpopular source of agricultural solutions.

- xii. Poor access to infrastructural facilities, mobile phone reception and signal coverage especially in rural areas
- xiii. Majority of farmers may be inclined to seek advice from alternative sources such as extension workers, friends and neighbours, which are more conventional.
- xiv. Lack of content/information in interactive voice response (IVR) based agriculture services. This is whereby the users interact with an automated service provider's host system through the use of touch-tone keypad and voice inputs, after which they can service their own inquiries by following the IVR dialogue.
- xv. Lengthy and tedious subscription process

2.1.2. Financial Unsustainability

This is usually a result of service costs exceeding the revenue generated thereby implying that the business cannot exist without external support. Barriers to the financial sustainability of ICT based agricultural solutions providers include:

- i. Poor pricing of the services from failure to accurately gauge the appeal of the service and willingness to pay– goes both ways – expensive or free
- ii. Most providers do not recognize and build on already existing structures, such as public extension systems
- iii. Most do not develop knowledge services targeted at the rural population which remains a potentially huge un-tapped market
- iv. Most are top down in nature and do not perceive what is desired and demanded by the community
- v. Lack of concept testing of different communication strategies/ delivery mechanisms to identify the most preferred – USSD, SMS, helpline, mobile application or IVR
- vi. Unavailability of venture capital funding that would allow the providers in the start-up phase to scale. This has been attributed to Africa's unpredictable weather patterns, poor soil conditions, long crop cycles, irregular market access, and volatile or high farm input costs making the services unappealing to potential investors
- vii. Over reliance on donor funding thereby remaining vulnerable to donor conditionalities, withdrawal and demands
- viii. Lack of an enabling environment e.g. broadband and electricity infrastructure providing for wider coverage especially in rural areas
- ix. Lack of public-private partnerships especially between the service providers and cooperatives that can offer subscriptions to their services at scale to farmers thereby reducing the service and operational costs
- x. Lack of appropriate financing options that do not leave the providers burdened with unsustainable debt repayment expenses
- xi. High operational expenses particularly those of collecting market information , staffing and maintaining sophisticated technological infrastructure

2.2. Framework used for selection of respondents

This study examined the business models from the perspective of fifteen ICT4Ag providers with the research being conducted through interviews with their representatives. These interviews were accompanied by an exhaustive review of resources and inputs from two ICT4Ag experts.

The ICT4Ag solutions targeted were selected based on six criteria:

- a. Value proposition involved offering non-financial services to the target customer segments

Types of agricultural non-financial services offered by mAgri solutions include:

- Information solutions (agronomic, weather, market)
- Expert advice and extension solutions (helplines, crop management and animal management)
- Supply chain management solutions (logistics, storage, transport, agro dealer stocks)
- Trading platforms (inputs, commodities, animals, equipment etc.)

- b. Crops they target

The services provided had to be focused on staple crops.

- c. Delivery mechanisms used

The solutions had to be utilizing ICT based channels in the delivery of their value propositions. Types of channels that were considered included:

- Mobile phone based – USSD, IVR, Mobile application, Helpline, SMS and OBD
- Web portals and website platforms
- Software package

- d. Country of operation

Solutions examined had to be operational in any of the three countries in which AGRA's Financial Inclusion for Smallholder Farmers in Africa Project is being implemented. These are Ghana, Kenya and Tanzania.

- e. Willingness to participate.

Providers had to express their willingness and had to be available to participate in the study that was geared towards getting insight into their underlying business models and demand for their services.

- f. Consultation with AGRA's Financial Inclusion for Smallholder Farmers in Africa Project team

Based on the aforementioned criteria, the assessment examined the business models of the following ICT4Ag solutions which are introduced briefly and discussed in additional detail in their respective in-depth case studies.

Kenya	
Solution	Description
1. WeFarm	Launched in Kenya in 2015, it is a free peer-to-peer knowledge-sharing platform that enables farmers to share information with each other via SMS. By utilizing the power of crowdsourcing, the service is able to connect farmers without the internet.

2.	Soko pepe	Launched in 2014, it provides farm records management services, weather updates and market information through four channels: SMS, field agents, web platform and hard copy record-keeping books.
3.	iShamba	Launched in 2015, iShamba delivers agronomic information, weather forecasts, market price information to smallholder farmers through three channels: SMS, call center and social media.
4.	M-shamba	The platform was launched in 2014 and provides extension solutions, agronomic information, transport linkages and a trading platform to farmers through three channels: SMS, USSD and a web platform.
5.	NAFIS	Established in 2009, the government-owned solution provides agronomic information, market price information and weather forecasts via IVR and website.

Ghana

Solution	Description
6. aWhere	The USA based company established in 1999 provides localized weather and agronomic data through its Weather aWhere™ product and also has an insight services product that provides weather and crop reports, assessments and analytics specific to client needs
7. mFarms	Launched in 2012, by the Ghanaian based software development company Image-AD, mFarms is a customizable module-based platform that facilitates the establishment and maintenance of business relationships among all VCAs and eases both communication and flow of goods and services among them.
8. VOTO Mobile	Integrating USSD, interactive voice calls and SMS channels in local languages the platform, that was established in 2012, allows organizations to perform their mobile engagement with farmers through distributing and collecting information
9. Ignitia	Launched in 2013, Ignitia provides daily, monthly and seasonal weather forecasts that are tailored to the tropics through SMS texts disseminated directly to subscribed farmers
10. Prep-eez	Prep-eez, a Ghanaian-based ICT consulting company, in 2015 launched the MasterCard Foundation Fund for Rural Prosperity Project which through IVR and a helpline delivers market linkage, transport solutions, mechanized services in addition to a range of financial services to smallholder farmers.

Tanzania

Solution	Description
11. mFarming	Launched in 2013 by Sibesonke Limited, mFarming provides smallholder farmers with information solutions (agronomic, weather forecast, and market price price) and market linkage through USSD, SMS and a web platform. For enterprise clients, it provides a communication and management platform through a web platform.
12. Regional Agricultural Trade Intelligence Network (RATIN)	The market information system which was launched in 2006 by the Eastern African Grain Council provides over seventeen (17) products - which include market price information, cross-border

	trade flows data, warehouse stock data, and regional food-balance sheets - through SMS, website, reports and newsletters
13. Agrinfo	The online platform that was founded in 2013 maps verifiable and accessible data about farmland (ownership, location, farm size etc.) and the crops under production using geographical information system technology. It also provides directory services meant to link input and output suppliers. The value proposition is delivered through field visits and USSD.
14. AGRInsight	The interactive mapping platform that was founded in 2013, through the use of cloud technology enables users to among others visualize overlaid maps containing private data, public data and agricultural information.
15. Bei Sokoni	The market information system launched in 2011 by BR Solutions offers information solutions (market prices, farm input profiles, and business directory) and supply chain management solutions to both smallholder farmers and organizations through SMS, USSD and IVR.

2.3. Assessment study instruments

Data collection that informed the lessons from this assessment were based on qualitative research methods. The data collection tools mentioned below and data analysis were informed by the survey objectives, research confidentiality standards and adhered to and followed AGRA's principles.

The instruments used were developed in English and the research was comprised of three main phases:

- a) Key informant interviews (Expert interviews)
- b) Desk Review
- c) In-depth service provider interviews

2.3.1. Desk review

The team conducted a wide-ranging literature review to collect secondary data. These included (but not limited to) wide-ranging literature, both online and offline, on ICT based agricultural solution provision in Kenya, Ghana and Tanzania.

Online resources review involved (but not limited to) exploring the websites of service providers operating in the individual countries, internet searches with keywords, and social media sites – Twitter, Facebook, blogs and online media outlets.

Offline resources review involved (but not limited to) key service provider documents, reports from various organizations involved in ICT4Ag solutions, case studies and other significant documents. Already published inventories and case studies were not replicated. A full bibliography of secondary information used can be found in Annex D.

2.3.2. In-depth interviews with service providers

To assess the business models of the fifteen ICT4Ag solutions (five per country), selected via the criteria outlined in section 2.1 above, in-depth interviews with their representatives (see Annex C below) were conducted following the guideline attached as Annex A below. These interviews were then translated into individual case studies which have been verified and amended by the respective service providers.

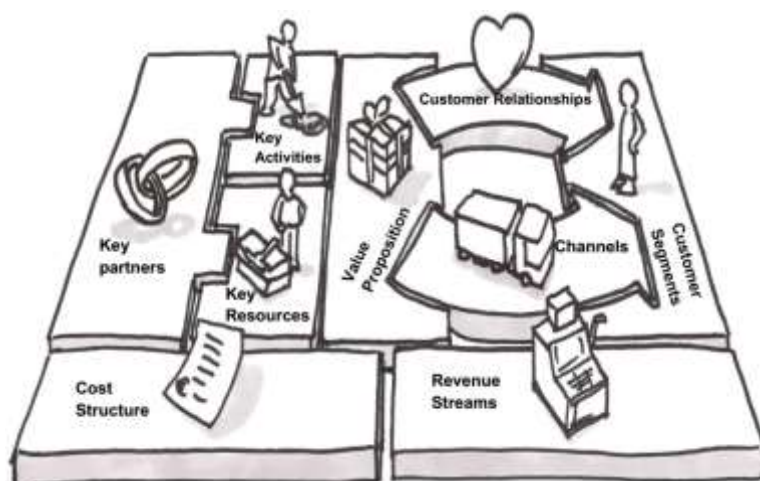
2.3.3. Key informant interviews (KIs)

This report is also based on interviews with 2 ICT4Ag experts who are familiar with the mAgri space in Africa with an in-depth understanding of business models underlying ICT-based agricultural service delivery. Additionally, they have both helped to develop, launch and optimize a suite of ICT4Ag products customized to the needs of smallholder farmers.

They were identified through recommendations from AGRA based on past contacts and work. The interviews were based on the interview schedule attached as Annex B below.

3. Results and Findings

3.1. Profile of the assessed ICT4Ag solutions



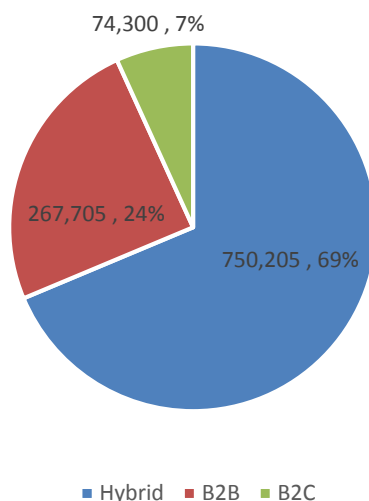
There were 15 ICT4Ag providers that were assessed in this study from Ghana, Tanzania and Kenya with each country represented by 5 solutions. Table 1 below shows the names of the solutions, country from which it was drawn, business model, stage in the business life cycle, number of years in business and current number of users.

ICT4Ag Provider	Country	Business Model	Stage in business life cycle	Years in business	Number of users
Ignitia	Ghana	Hybrid	Development / Seed Stage	3	80,000
mFarms		B2B	Established/ Maturity stage	4	16
VOTO		B2B	Growth	4	9,800
Prep-eez		B2C	Development / Seed Stage	1	8,000
aWhere		B2B	Established/ Maturity stage	9	30
Agrlinsight	Tanzania	B2B	Growth	3	2
mFarming		Hybrid	Growth	3	5
Aginfo		Hybrid	Development / Seed Stage	3	5,200
Bei Sokoni: BR Solutions		Hybrid	Start-Up	5	300,000
RATIN		B2B	Development / Seed Stage	10	-
iShamba	Kenya	Hybrid	Development / Seed Stage	1	350,000
Sokopepe		B2C	Development / Seed Stage	1	6,300
M-shamba		Hybrid	Growth	5	15,000
WeFarm		B2B	Development / Seed Stage	1	72,000
National Farmers Information Service (NAFIS)		B2C	Growth	6	60,000

3.1.1. Number of Users

Data available for 14 ICT4Ag solutions indicate 1,092,210 users of the non-financial services. Of these, majority are covered by the Hybrid model, as shown in the pie chart below.

Chart 1: Distribution of users by business model across 14 ICT4Ag solutions.



3.1.2. Business Model

The business models adopted by the providers included in the review are split evenly between B2B (n=6) - where the companies derive revenue from organizations and farmers don't pay and the Hybrid models (n=6) whereby a company has two revenue streams, i.e. smallholder farmers and enterprise clients.

Stage of development

The assessed ICT4Ag solutions were categorized into 4 stages of the Business Life Cycle:

- i. Development / Seed Stage – this is where proof of concept is conducted through testing and piloting of the service (Lasts 2 years)
- ii. Start-Up – business is incorporated and made legal and the provider starts marketing and selling the services to establish a customer base and market presence (Lasts 1 year)
- iii. Growth – Service is steadily generating revenue and acquiring new customers though it might be operating at a net loss or maintaining a healthy profit (Lasts 2 years)
- iv. Established/ Maturity stage – Service has a dominating presence in the market, has slower growth, and is able to generate and maintain profits.

As highlighted in the table below, a greater number of the reviewed solutions (n=7) are in the development stage, 1 is at start up, 5 are at growth stage, and 2 are mature.

Business Model / Stage of Growth	Development / Seed Stage	Established/ Maturity stage	Growth	Start-Up	Total
B2B	2	2	2		6
B2C	2		1		3
Hybrid	3		2	1	6
Total	7	2	5	1	15

Majority of the providers had been in business for 5 years or less. The oldest solution is RATIN which has been in operation for 10 years; 4 solutions have been in operation for 1 year only.

3.2. Customer Segments



- Government agencies
- Civil society comprising of local and international NGOs, and farmer-based associations and cooperatives

This distribution is shown in the table below:

Target client	Key customer subgroups
Farmers	<ul style="list-style-type: none"> • Small holders • Commercial growers
Supply and value chain actors	<ul style="list-style-type: none"> • Agro-input suppliers • Agricultural service providers • Software companies • Processing companies e.g. food and beverage • Transporters • Warehousing /Supply chain management agencies
Marketing actors	<ul style="list-style-type: none"> • Traders, including multinationals • Commodity exchange actors • Cereals boards • Grain and fresh produce traders
Financial/investment institutions	<ul style="list-style-type: none"> • Micro finance • Insurance • Banks • Sacco • Mobile money providers • Investment groups
Government agencies	<ul style="list-style-type: none"> • Government agencies
Civil society	<ul style="list-style-type: none"> • Local NGOs and CBOs working with farmers • International NGOs and donors • Farmer associations

The business models denote broadly, the major customer segments across the 3 countries.

The 'customer sub-groups' targeted by these providers were:

- Farmers (small holders and commercial)
- Supply and value chain actors
- Financial institutions

Table below shows the spread of specific customer subgroups within the aforementioned business models.

ICT4Ag Provider	Model	small scale Farmers	Commercial farmers	Supply chain and value addition	Marketing	Finance / Investment	Govt.	Civil Society (NGOs, donors, CBO)	Farm based Society
Ghana									
Ignitia Tropical Weather Forecasting	Hybrid	x						x	
mFarms	B2B			x			x	x	x
VOTO	B2B	x		x			x		
Prep-eez	B2C	x							
aWhere	B2B		x	x			x	x	
Tanzania									
Agrinsight	B2B			x		x			
mFarming	Hybrid	x		x			x	x	
Agrinfo	Hybrid			x		x	x		x
Bei Sokoni	Hybrid	x				x	x	x	
RATIN	B2B			x	x	x	x	x	
Kenya									
iShamba	Hybrid	x		x	x	x			
Sokopepe	B2C	x			x	x		x	
M-shamba	Hybrid							x	x
WeFarm	B2B			x					
NAFIS	B2C	x		x					
Total solutions		8	1	10	3	6	7	8	3

The majority of the services are targeted to supply chain and value addition actors (n=10), small holder farmers (n=8); civil societies (n=8) and government agencies (n=7). The spread of clients is indicated in the table (Matrix).

About half of the solutions (n=8) target at least 4 customer subgroups and 2 target only 1 customer segment i.e. Prep-eez in Ghana and WeFarm in Kenya.

The number of customer groups targeted by the 15 assessed ICT4Ag solutions are outlined in the table below:

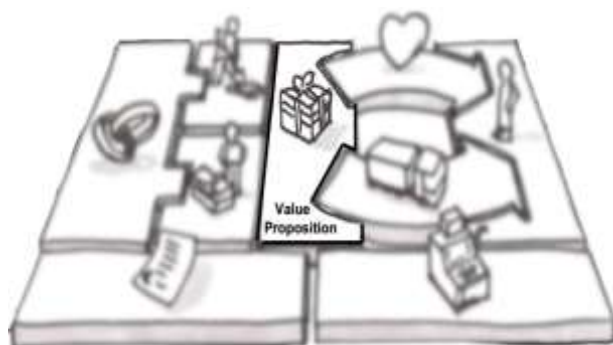
Customer segments targeted	Number of ICT4Ag providers
1	2
2	4
3	1
4	7
5	1

Discussions on how to sustain uptake and financial sustainability

Since majority of the providers target more than one customer segment, they can scan their environments and identify strategic partners that could enhance their visibility and reach to these clients. Civil society groups are important in reaching farmers in underserved and rural areas. Providers could leverage on such partnerships e.g. for livelihood, poverty eradication, women and youth empowerment NGOs, to market their products.

Government agencies are important customer segments particularly in giving businesses the much needed credibility particularly in settings that harbor distrust for providers. Rural farmers are more likely to sign up in initiatives fronted by government. Partnership with government also enhances the public-private partnership initiatives in which competitive advantages across these divides are harnessed optimally. Examples include access to cross-border markets, partnerships with other government agencies in the region that could provide access to yet more strategic partners. Government is also an important actor for policy development e.g. for market access, strengthening supply chains for inputs, development of land tenure and use policies and even enrichment of curricula of agricultural courses in institutions to conform to technological shifts in agricultural practices. Though the providers indicate that they target government agencies, it is not clear what levels of engagement are involved. Providers should adopt strategies of engaging local government actors e.g. chiefs and village elders, while observing existing government protocols of engagement. A big challenge in governments would be to how best to deal with various actors in the bureaucracies whose interests may feel threatened by ICT4Ag innovations e.g. solutions that seek to circumvent middlemen would also face resistance if such middlemen actors patronage government bureaucracies.

3.3. Value Proposition



The non-financial services offered by the 15 assessed ICT4Ag providers can be categorized into:

- Information solutions (agronomic, weather, market price)
- Expert advice and extension solutions (helplines, crop management and animal management)
- Supply chain management solutions (logistics, storage, transport, agro dealer stocks)
- Trading platforms (inputs, commodities, animals, equipment etc.)
- Financial information and products

Specific services provided in these categorizations are depicted in the table below:

Value proposition	Non-financial services provided	Implication (Unique value)
Information solutions	<ul style="list-style-type: none"> • Accurate, localized weather forecasts • Mapping consolidated agricultural information and visualization 	<ul style="list-style-type: none"> • Supporting farmers them in decision making e.g. on planting/ types of crops to cultivate; (Dissemination in English and Swahili enhances consumption of information by farmers) • Consolidate information, shows relationships between key variables to create 'big picture'. • Support intervention measures.

	<p>aids/Mapping fire outbreaks</p> <ul style="list-style-type: none"> • Agronomic information i.e. Mobile curriculum and content libraries; Farmer surveys and calendars • Free communication platforms for peer support. • Market price information 	<ul style="list-style-type: none"> • Enhance farmers' access to current information/ best practices • Needs assessment through scientific research • Interaction with peers from all over the world, implying diversity; free platform meaning cost of getting information is significantly reduced. • Timely information supports decision-making to sell/ buy and reduces transaction costs
Expert advice and extension	<ul style="list-style-type: none"> • Crop production management • Extension monitoring of field agents /Management of subsidized agricultural input • Mechanized services • Dynamic agronomic modeling • Farm management / diagnostic tools 	<ul style="list-style-type: none"> • Some extension services are specific to crop cycle (e.g. M-shamba, implying targeted interventions). • Implying enhanced accountability • Enhance efficient farm production • Project various farming scenarios tailored to different contexts • Enhance needs assessment and information on best practices
Supply and value chain management	<ul style="list-style-type: none"> • Management of value chain actors • Transport solutions • Link input and output suppliers • Monitoring of stock, purchases, return products and supply in real time 	<ul style="list-style-type: none"> • Enhance timeliness of supplies to farmers/ raw produce to processors • Enhance efficiency, control and information for decision-making in business.
Financial information and products	<ul style="list-style-type: none"> • Credit facilities • Micro insurance 	<ul style="list-style-type: none"> • Provide capital for farming • Protection against risks
Trading platform	<ul style="list-style-type: none"> • Cross border data • Food-stock balances of critical commodities 	<ul style="list-style-type: none"> • Reduce transaction costs; could enhance international trade • Gives picture of supply and demand for critical commodities.

	<ul style="list-style-type: none"> • Business directory • Link farmers to market for produce 	<ul style="list-style-type: none"> • Link of buyers to sellers/ potential sellers. • Reduce post-harvest loses.
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The table below shows the distribution of these value propositions across countries and models:

ICT4Ag Solution	Model	Information solutions	Expert advice and extension solutions	Supply chain management solutions	Trading platform	Financial products
Ghana						
Ignitia	Hybrid	x				
mFarms	B2B	x	x	x		
VOTO	B2B	x			x	
Prep-eez	B2C	x		x	x	x
aWhere	B2B	x				
Tanzania						
Agrlinsight	B2B	x				
mFarming	Hybrid	x		x		
Agrinfo	Hybrid	x	x	x		
Bei Sokoni	Hybrid	x		x		
RATIN	B2B	x				
Kenya						
iShamba	Hybrid	x	x			
Soko pepe	B2C	x	x		x	
M-shamba	Hybrid	x	x	x	x	
WeFarm	B2B	x				
NAFIS	B2C	x				

Seven solutions offered only one category of services - information solutions; Three solutions offer 3 categories of services i.e. mFarms, Agrinfo and Soko pepe.

Information solutions

All providers offered information solutions (n=15) hence making it the dominant category of non-financial service provided. The key strength of Information solutions as a value proposition was based on supporting farmers and key stakeholders in decision making e.g. on crop and animal husbandry. Since the most up to-date information is provided and in some instances tailored to specific crop production cycle (e.g. M-shamba, Kenya), it is expected that farmers would get better yields or income from these applications. Weather Forecasts were value propositions for 5 of the reviewed providers. Accurate and reliable weather forecasts support farmers in making decisions on timing of crop planting; weather patterns also determine the type of crop that can be cultivated. This is important for Sub-Saharan African countries whose population mostly depends on rain-fed agriculture and where climate change impacts the traditional crop patterns.

Farmers' surveys (e.g. VOTO, Ghana) provide stakeholders and decision-makers with information on needs of farmers hence build the evidence base for future interventions. Providers such as mFarming in Tanzania have tailored the messages to English and Swahili to enhance communication with farmers. VOTO provides information through voice, which is important for illiterate farmers. A similar unique initiative by WeFarm in Kenya fostered interaction of farmers across the world for peer information exchange, on a free platform. Only 2 of the reviewed providers - Agrinsight and Agrinfo, in Tanzania based their value propositions on mapping agricultural data and visualization, to build the big picture. This is important in supporting key stakeholders in understanding complex information and how they relate within an agricultural lens. Some of the variables include land and crop-data hosting and mapping of fire hazards.

Expert advice and Extension solutions

Five solutions provided these services to farmers; This value proposition includes activities such as crop production management, monitoring extension workers (e.g. mFarms in Ghana) and animal husbandry, farm management (e.g. Agrinfo in Tanzania and Sokopepe in Kenya), provision of agricultural best practices (e.g. I shamba in Kenya). Expert advice is an important service to farmers, particularly the small holders, who may not have access to the latest information that would support optimum yields for farmers. In the Kenyan context, agricultural extension services have greatly decreased over years, leaving farmers without adequate support.

Supply chain management solutions

These are provided by 6 ICT4Ag providers. Supply chain activities involve a range of services including logistics, administration of smallholder supply and provision of mechanized services (e.g. Prep-eez, Ghana); this would support efficient farming practices, particularly for smallholder farmers who traditionally rely on human labor in cultivating their farms. Others include managing a range of Value Chain Actors e.g. mFarms in Ghana. Other providers link input and output suppliers e.g. Agrinfo in Tanzania and M-shamba in Kenya. All these activities aim to ensure that farmers get input to their farms and their produce to the markets on time. These services also support tracking of stocks, returns of suppliers in real time, enhancing business decisions. The agricultural market has high price elasticity; depending on the season, a delay may mean a difference in optimum profits or significant losses.

Transport solutions e.g. Prep-eez in Ghana as a value proposition is unique, in that it supports delivery of farm produce to markets. In contexts of poor transport services especially in rural areas, farmers lose many market opportunities, undermining the initial objective of investments in farming.

Trading platform

This entails the process of facilitating the trading in agriculture produce, inputs, animals, and equipment. Market access is the ultimate stage that significantly determines whether farmers would get returns on their investments and these platforms are meant to address the exploitation of farmers by unscrupulous middle-men, enable farmers to benefit from price discovery before deciding what to plant, and through increased transparency help farmers realize fair market value for their yields. Linking farmers and buyers of commodities on electronic exchange platforms could also significantly enhance efficient trade through reduction of transaction costs.

In the study, these services were being provided by 4 ICT4Ag solutions i.e. VOTO and Prep-eez, in Ghana; and Sokopepe and M-shamba from Kenya.

Financial Services

Although the research focused on providers offering non-financial services, Prep-eez in Ghana was found to be a solution that had bundled financial services with the non-financial services they provided. Prep-eez offers credit and micro-insurance services to farmers.

These services are important to small holder farmers as they mostly lack access to capital and with tailored micro insurance products, farmers can confidently invest in quality inputs, increase their productivity and access agricultural loans.

3.3.1. Sources of content

Sources of content used in the creation of the value propositions varied from one ICT4Ag solution to another and can be categorized into six: internal experts, service providers, external consultants, government agencies, NGOs and clients themselves.

Internal staff were the dominant source of the content delivered (n=13) e.g. iShamba has among others in-house agronomists and veterinary officers who develop the agronomic information disseminated to farmers. Others include service providers (n=7) i.e. Sokopepe which distribute market price information collected from other service providers offering market information services. 6 providers relied on government agencies as their sources of content. This includes mFarming (Tanzania) which partners with the Tanzanian Ministry of Agriculture, Food Security and Cooperatives, and the Ministry of Livestock and Fisheries Development for content development.

The table below outlines a summary of these sources of content used to create the delivered value propositions.

ICT4Ag solution	Model	Internally	Service providers	Experts/ Consultants	Government agencies	NGOs	Clients
Ghana							
Ignitia	Hybrid	x	x				
mFarms	B2B	x	x			x	
VOTO	B2B	x		x			
Prep-eez	B2C	x					
aWhere	B2B	x	x		x		
Tanzania							
Agrlinsight	B2B		x		x		x
mFarming	Hybrid	x			x		
Agrinfo	Hybrid	x			x		
Bei Sokoni	Hybrid	x					x
RATIN	B2B	x	x		x	x	
Kenya							
iShamba	Hybrid	x	x				
Sokopepe	B2C	x	x				
M-shamba	Hybrid	x		x			
WeFarm	B2B						x
NAFIS	B2C	x			x		
Total		13	7	2	6	2	3

Discussions on how to sustain uptake and financial sustainability

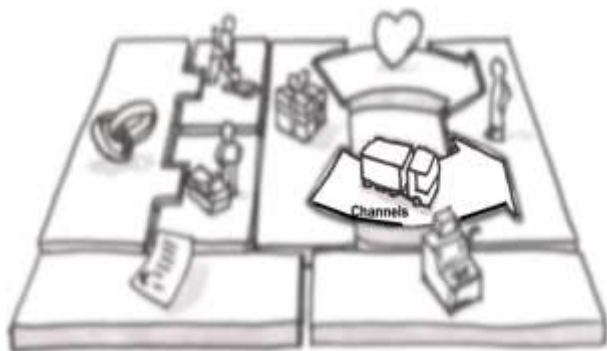
Accurate and timely delivery of information to farmers may have significant impact on their production and final sales of their produce. Some crop and animal species are extremely sensitive to weather variations; production processes such as pesticide spraying and fertilizer are also timed according to local weather elements. Providers have adopted mechanisms of delivering information to farmers through push e.g. dissemination of SMS and pull strategies (generating demand of information), circumventing geographical, time and language barriers. Tailoring this information to specific crop or animal production cycles enhances targeting and utilization of the information.

Providers should ensure their value proposition positioned to tackle actual challenges within the agricultural ecosystem explains the benefits and outcome of using their service/ product, who the target end-users are and how it solves their biggest pain points specifically. The developed value propositions should be continuously refined by translating customer feedback data into the service development process. When the volume of feedback becomes overwhelming, providers can opt for an observe-and-react approach whereby upgrades and enhancements are made after a specified number of requests.

In addition to having a strong business case, bundling of ICT4Ag non-financial services particularly information solutions with other services that farmers are willing to pay for such as trading platforms and financial services can create additional value for end users, increase revenues and stimulate uptake and usage.

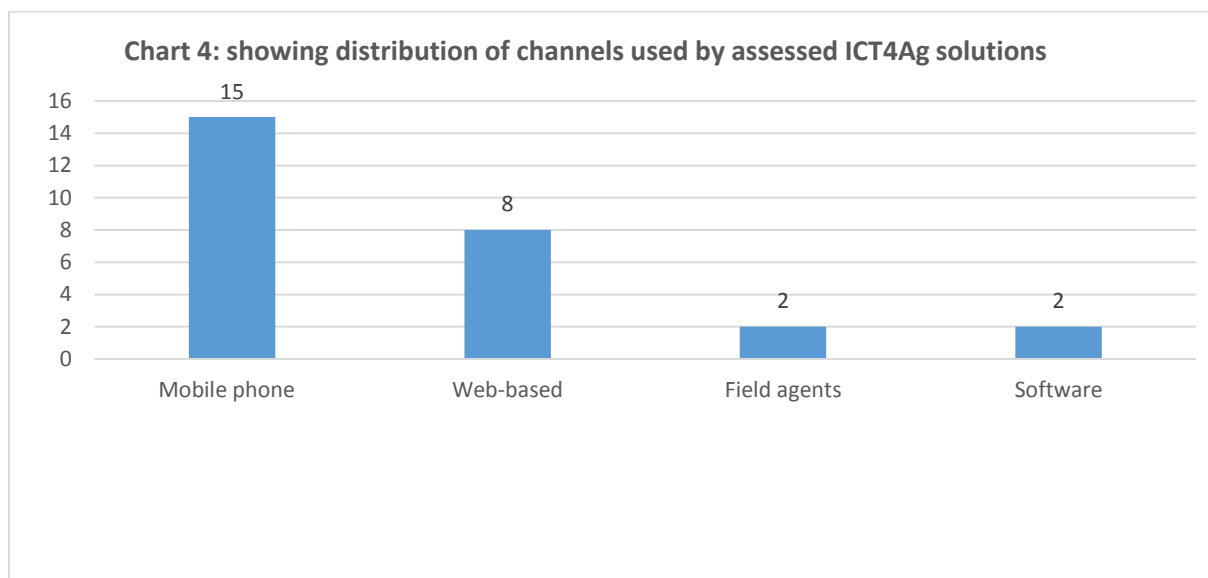
The minimum viable product which is a pared down version of the platforms that minimizes business risks by offering only the essential features while satisfying early adopters should be conceptualized by providers as the first product to go to market while iterations are made after launch.

3.4. Channels



Eight main channels grouped into 4 below were used by the assessed providers:

- a) Mobile phone-based applications e.g. USSD, IVR, SMS, and helpline
- b) Web based applications e.g. website, social media, reports and web portal
- c) Direct face to face communication by field agents
- d) Software e.g. application programming interface (API)



Web based applications were used more in Kenya, (n=4) compared to Ghana (n=2) and Tanzania (n=2). Majority of the providers (n=9) used 2 channels, only one provider i.e. Sokopepe used 3 channels while only one channel was used by the remaining 5 providers.

An analysis of the channels within the mobile phone category shows that 11 providers have adopted SMS for content delivery, 6 of them use USSD, 5 IVR, 4 have a web-portal and 3 have a website. Only 2 have a helpline in place. This is represented in the table below

	Service Provider	Channel	Target Customer segments
Kenya			
1.	WeFarm	SMS Website	<ul style="list-style-type: none"> • Smallholder farmers • Enterprise customers
2.	Sokopepe	Farm Book SMS Web portal	<ul style="list-style-type: none"> • Smallholder farmers and farmer groups • Input suppliers • Financial sector players e.g. Banks, insurance, MFIs, saccos, mobile money providers • NGOs and donors • Domestic market traders of fresh produce
3.	iShamba	SMS Call centre Social media	<ul style="list-style-type: none"> • Smallholder farmers • Commercial organizations
4.	M-shamba	SMS IVR	<ul style="list-style-type: none"> • Small-holder farmer groups/ associations/ co-operatives • NGO's • enterprises working with farmers
5.	NAFIS	Website IVR	<ul style="list-style-type: none"> • Value chain actors (smallholders farmers, agro input suppliers, agro-processors, agro-traders, and agro transporters) • Other Agri value chain service providers e.g. ICT4Ag solutions and extension service providers
Ghana			
6.	aWhere	API Custom dashboard	<ul style="list-style-type: none"> • Last mile agricultural service providers

			<ul style="list-style-type: none"> • Agricultural software companies • Commercial growers • Supply chain actors like food and beverage companies • Agribusinesses • Traders • NGO's and development agencies • Governments and multi-nationals
7.	mFarms	SMS IVR USSD Web portal	<ul style="list-style-type: none"> • Farmer based organizations • Processing companies • Agro-input dealers • Warehouse companies • Institutions (mainly government agencies and NGOs)
8.	VOTO	IVR SMS USSD	<ul style="list-style-type: none"> • Organizations - agri-businesses, governments, and NGOs • Smallholder farmers being served by the organizations
9.	Ignitia	SMS USSD	<ul style="list-style-type: none"> • NGOs and INGOs • Farmers in tropical regions
10.	Prep-eez	IVR Helpline	<ul style="list-style-type: none"> • Smallholder farmers
Tanzania			
11.	mFarming	SMS USSD Web platform	<ul style="list-style-type: none"> • Smallholder farmers • Agribusinesses • Government agencies, donors and NGOs
12.	RATIN	SMS Website Reports	<ul style="list-style-type: none"> • Farmers • Grain market actors including traders, processors, and commodity exchanges • NGOs, donor funded programs, and civil society e.g. FAO • Supporting institutions and services including banks and insurance companies • Cereal boards, government agencies and policy makers • Academic Researchers
13.	Agrinfo	USSD Field visits	<ul style="list-style-type: none"> • Farmer Associations • Input and output suppliers • Insurance companies • Microfinance institutions • Government of Tanzania
14.	AGRInsight	SMS API	<ul style="list-style-type: none"> • processors and agribusinesses • government departments and subsidiary government agencies facilitating agribusiness investment
15.	BR Solutions	SMS USSD	<ul style="list-style-type: none"> • Smallholder farmers; • Government agencies; • Financial institutions; • CBOs and NGOs; and • Corporate

It is worth noting that, as a key challenge they faced in the delivery of their services, 7 providers stated SHFs view solution providers with some suspicion and mistrust due to previous providers having defrauded them as well as the old generation's preference for face-to-face interaction and skepticism towards ICT-based solutions. Moreover, 6 providers noted that low literacy rates among target users have been a barrier in user capability to comprehend the content they receive in formal languages and navigate through the adopted channels to benefit from the use of the technology.

Language and technical illiteracy affects especially USSD platforms based services. Sokopepe, M-Shamba and Ignitia opted to limit the length of texts whereas mFarms translates messages to local languages to circumvent language challenges. Technical challenges have necessitated training of users before adoption of services. According to Agrinfo, trained farmers were expected to share the information with others. It is also challenging to translate technical language to a form that communicates the meaning effectively to the farmers (VOTO). Some providers like aWhere, who have permitted third parties to use their platforms, report limited capability of such parties to effectively integrating these platforms to theirs. This implies lost opportunities to customize services and reach more farmers. It also means that the provider platforms are not used efficiently.

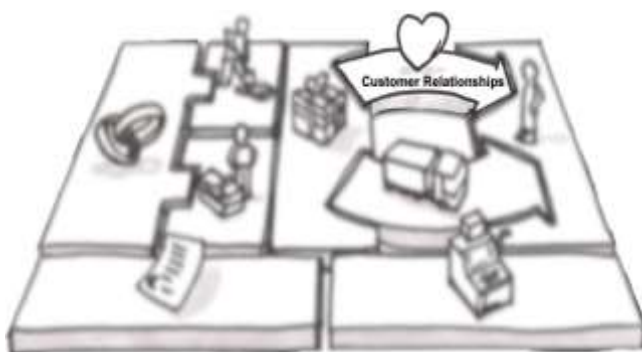
Discussions on how to sustain uptake and financial sustainability

Field agents are important channels of information. However, appropriate incentives should be provided to them to motivate them to do their work effectively, and to retain them. Providers targeting same geographical zones could also collaborate and utilize fewer field agents and enhance operational efficiencies. Providers should also expand use of the local community networks, to enhance acceptability of services among residents.

A cursory look through social media platforms like Facebook indicates that youth and more tech-savvy users are increasingly venturing into agriculture. Such platforms should be utilized by providers in spreading the word among these populations about existing services as well as networking people of similar interests. However, such platforms need an active customer care support to engage the users and respond to their issues within agreeable timeframes.

It is imperative that ICT4Ag providers ensure their delivery channels are cost effective, scalable and flexible in order to meet the different needs of their customer segments and broaden their user base. Other key factors that should guide the adoption of delivery channels include both language and technical literacy of the target customer segments, user preferences, potential for automation, and value proposition e.g. nature of the information.

3.5. Customer Relationships



Personalized relationships were preferred by 10 providers, while 9 providers preferred automated relationships. Personalized relationships entailed direct contact with field agents e.g. production information agents used by Sokopepe, customer support, consultancy and advisory services (AGRIinsight, Tanzania). Six providers preferred personalized services

exclusively, while 4 providers preferred automated relationships exclusively. These included automated SMS services (Ignitia, Ghana & RATIN, Tanzania), and automated voice machines. Ignitia and Prep-eez in Ghana are the only providers that had adopted co-creation partnerships with non-governmental organizations. Co-creation is an innovative way that involves clients in shaping the product design and could enhance uptake and ownership of products.

The table below shows the customer relationships adopted by ICT4Ag providers across all countries.

ICT4Ag solution	Model	Automated	Personalized	Co-creation
Ghana				
Ignitia	Hybrid	x		x
mFarms	B2B		x	
VOTO	B2B	x		
Prep-eez	B2C	x	x	x
aWhere	B2B	x	x	
Tanzania				
Agrlinsight	B2B		x	
mFarming	Hybrid		x	
Agrinfo	Hybrid		x	
Bei Sokoni	Hybrid	x		
RATIN	B2B	x	x	
Kenya				
iShamba	Hybrid	x	x	
Sokopepe	B2C		x	
M-shamba	Hybrid		x	
WeFarm	B2B	x		
NAFIS	B2C	x		
Total		9	10	2

While automated services may be efficient in cutting down costs of human resources, they may be perceived as non-responsive and distant from users. Language barriers especially for rural farmers also limit usage.

A key challenge faced by providers (n=4) related to this component is insufficient marketing. Providers have limited funds to alternate face-to-face (Below The Line) marketing channels e.g. agent networks, with mass media (Above The Line) channels like radio adverts that are key in raising awareness on their service offerings, reaching a wider rural audience and educating users on the available functionality and content.

Discussions on how to sustain uptake and financial sustainability

Customers want to be made to feel important, and this is best communicated through the quality of services that they receive from the providers. Majority of the providers have mixed personalized and automated customer interactions. Whereas automated customer relationships may enhance efficiency through minimizing human resource costs, in some instances they may limit responsiveness to customer needs. Mobile phone network downtimes may also mean that farmers get limited access to services when they need them. However, few of these providers have adopted co-creation partnerships. These are important in enhancing customer involvement in product development and innovation, collecting important feedback that could enhance customer ownership of the services. It however may be a challenge for providers involving individual farmers directly due to operational difficulties in accessing these farmers. Providers could commission surveys to collect data on the customer experience of their products, though this could be unaffordable to some solutions.

However, while customer feedback data does create competitive advantage, the advantage doesn't come from merely collecting the data but on how providers act on it to close the loop with the customer thus resulting in change their customers can see.

Overreliance on a very small number of clients as commonly seen in ICT4Ag solutions utilizing the B2B business model leaves the service vulnerable to cash flow problems when the clients on-board delay making payments, are unable to pay or cancel their subscriptions. Providers should therefore avoid spreading themselves too thin by relying on a very small client base.

3.6. Revenue Streams



The table below outlines the distribution of revenue streams across providers across the 3 countries:

Country	Model	Usage fees	Subscription	Advertisement	Data	Commission/ Consultancy	Grants for OPEX
Ghana							
Ignitia	Hybrid	x	x				
mfarms	B2B		x				
VOTO	B2B		x			x	x
Prep-eez	B2C	x	x			x	
aWhere	B2B		x				x
Tanzania							
Agrlinsight	B2B		x			x	
mFarming	Hybrid	x	x				
Agrinfo	Hybrid		x			x	
Bei Sokoni	Hybrid	x	x			x	
RATIN	B2B			x	x		x
Kenya							
iShamba	Hybrid	x					x
Soko pepe	B2C	x	x			x	x
M-shamba	Hybrid		x				
WeFarm	B2B				x		x
NAFIS	B2C						x
Total		6	11	1	2	6	7

Revenue streams for ICT4Ag solutions range from 1 to 4. Ten providers have 1 and 2 revenue streams – $n=3$ and $n=7$ respectively, while 4 solutions have 3 revenue streams. Soko pepe was the only solution with 4 revenue streams.

Sources of revenue include usage fees, subscription fees, advertisement, commission, data selling and grants for OPEX.

The table below shows various specific sources of revenue

Revenue Streams	Description
Usage fees	Farmers charged each time they use service
Subscription fees	Directory services Client subscriptions License fees
Advertisement revenue	Advertisement revenue
Data selling	Historical data sets
Commissions/consultancy fees	Weighing and valuation Commissions from suppliers Maintenance of platforms Underwriting insurance for farmers Commissions for securing market Commission on mobile money services Consultancy fees for various services
Grants for OPEX	Donor funding

The main revenue streams are subscription (n=11), commissions/consultancy fees (n=6), usage fees (n=6) and grants from OPEX (n=7).

Five providers highlighted that the ability to pay and willingness to pay among most rural SHFs is low resulting in a high-dependence on donor and equity funding. Moreover, potential users are not accustomed to paying for services other than core communication (voice and SMS).

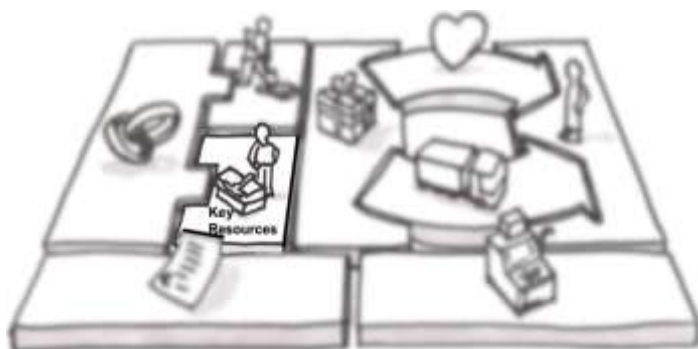
Discussions on how to sustain uptake and financial sustainability

Increased revenues are an important indication of how well a business is doing and prospects of scaling up. An important consideration for providers is how to increase their pool of customers who are paying for the services. This is because some of the current users of these services are either using them free of charge, or are paid for by other organizations, including operational grants. This raises critical questions about sustainability of providers.

Expansion to foreign markets is an important strategy in expanding customer base, but should be given careful thought because market contexts differ and successes in one country cannot necessarily be transferred to another.

Whereas most providers look at monetizing their databases either through advertising or/and selling the large amounts of data and feedback they collect from farmers, they must create sufficient value for their target clients specifically by building a critical mass of farmers on its database.

3.7. Key Resources



Key resources for the assessed ICT4Ag solutions were categorized into 4:

3.7.1. Physical

This category includes physical assets that included: offices, ICT infrastructure and vehicles.

The 15 providers identified a total of five physical assets that facilitate their delivery of the value propositions to their target customer segments. 14 of the providers had offices as their main physical resources; these offices in certain instances were in more than one country e.g. RATIN has offices in the 10 respective countries it operates in with the regional headquarters located in Kenya.

Additionally, 12 providers indicated ICT infrastructure. Only 4 providers have vehicles.

3.7.2. Human

Employees are a critical aspect of growing any business and ICT4Ag providers have invested their capital in staff with the aim of building high-performing teams that bring in a return on their investments (ROI).

The total number of staff across all providers was estimated to be 322 at the time of the study. The employees were classified into two main categories i.e. Permanent staff and temporary staff including consultants and volunteers. Permanent staff included software developers, sales staff, project managers, administration staff, field agents, monitoring and evaluation officers, and field agents.

In certain cases the number of temporary staff was unspecified and in certain cases, the firms were silent on the type of employment an employee was in. Using the disclosed number of staff, the median number of staff was 14 employees per solution provider.

3.7.3. Financial

Financial resources included generated income, grants offered from private and public sources, loans, award cash prizes, private equity, direct investment, venture capital, and lines of credit.

Financial resources varied across the providers, ranging from 175,000 to 3 million USD.

Grants were the main financial resources, having being accessed by 13 providers. Ten providers have only one key source of finance, three have 2 sources while two have 3 sources of finances. Reliance on donor funding was noted to be a serious threat to the sustainability of some providers should the funders shift their focus of funding.

Five organizations generated their income from the services they are offering through subscriptions and one off payments.

Funding was highlighted by 6 providers to be a key challenge in the delivery of ICT4Ag solutions. Most providers lack access to medium and long term finance even if they have overcome the challenge of raising high initial capital required to develop and implement their solutions.

3.7.4. Intellectual

These comprised mostly of different forms of intellectual property (IP) including patents, trademarks, copyrights, customer databases and brands which can be franchised/ bought/ licensed by the providers to others, spreading their knowledge-intensive technologies internationally.

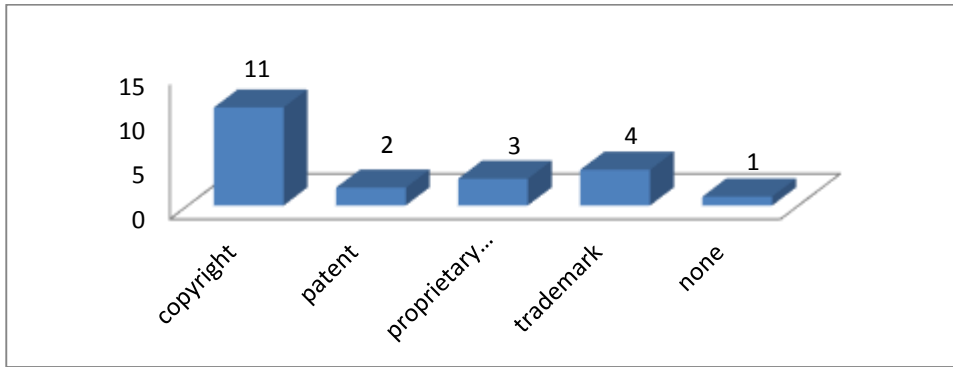
Eleven providers had copyrighted their solutions; Bei Sokoni has 4 copyrights on the software developed: Market prices, directory services through mobile phone, security alert system and sale services through mobile adverts.

Other IP examples are:

- Trademarks i.e. aWhere which has multiple trademarks including aWhere™ and weather terrain™
- Patents such as the patented mobile technology under mFarming
- Proprietary algorithms such as Ignitia's, that simulates tropical weather patterns with its team of scientists having invested over 6 years developing a hybrid approach to forecasting the weather in West Africa

Only Agrinfo lacked any form of intellectual property. Two of the providers had patents and four had a trademark i.e. WeFarm, NAFIS, aWhere and RATIN.

The figure below highlights a summary of the distribution of the intellectual property across all service providers.



As discussed above, effective enforcement of patent and copyright terms could enhance collection of revenue from the users through royalties hence enhancing sustainability of ICT4Ag solutions.

Discussions on how to sustain uptake and financial sustainability

Physical resources like buildings and vehicles can be rented and leased rather than purchased, to avoid sunk and recurrent costs. Hiring local staff could enhance local work processes because they can more easily interact with the target community members. A mix of incentives can motivate staff that work for ICT4Ag providers, enhance productivity and potentially cut down on costs. These include good working environments, realistic work targets and reward schemes. Providers could also use volunteers in the formative stages. Collaboration during marketing campaigns may also make utilization of human resources more cost-effective.

In addition to exploring and following up new business opportunities, attracting donor and impact investment funding, and identifying trendsetter ideas building strong management teams keep the team running smoothly and morale high while ensuring the solutions adequately address the agriculture ecosystem needs.

3.8. Key Activities



Content development, information technology development, and marketing are the key activities dominating operations in 9, 8 and 7 ICT4Ag solutions respectively. Content development includes data collection, verification, market information and record keeping services. Examples of information technology development activities include surveys on mobile phones (VOTO, Ghana), platform development

(Agrinfo, Tanzania); Marketing activities include field visits to subscribed farmers, customer support (aWhere, Ghana) and sales.

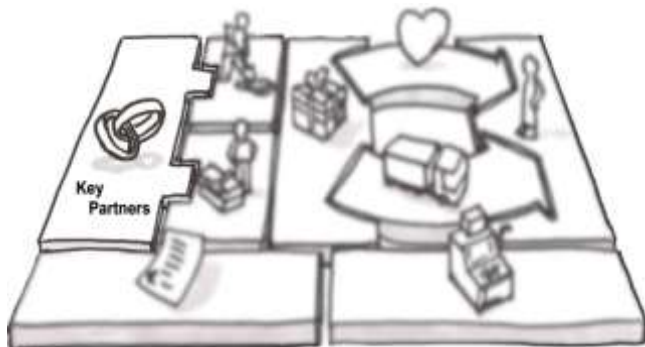
Majority of the providers focus on one key activity (n=8), five providers focus on 2, while two focus on 3 activities. It is instructive that half of the providers do not have marketing as a key activity. This could have significant implications on uptake of their products and future sustainability of the businesses.

Discussions on how to sustain uptake and financial sustainability

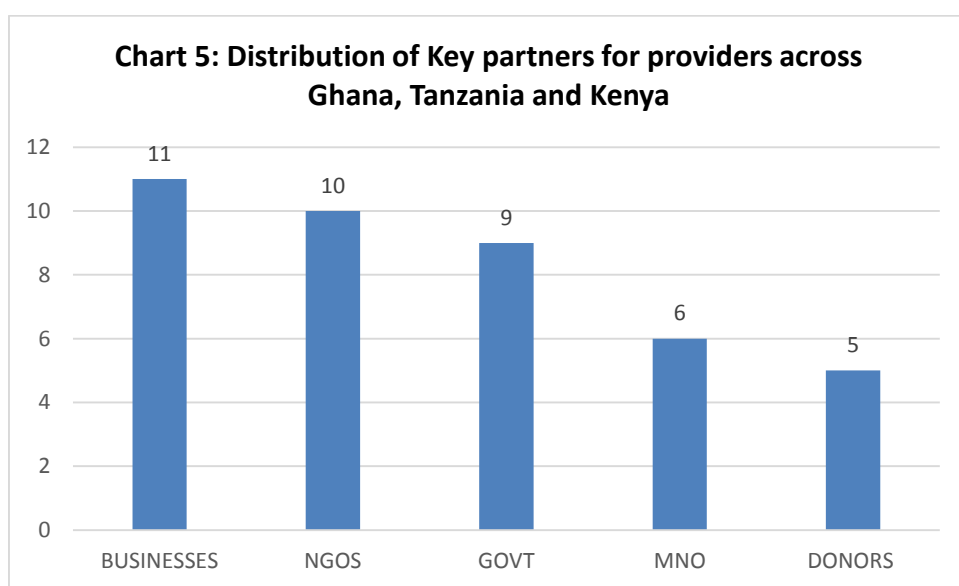
Content development can be enhanced through regular updates of contextually feasible information on internet/ mobile based platforms. Marketing activities should be effectively targeted to population segments that can effectively use them. Social media platforms are important in targeting youth, since the costs are minimal and social media platforms have

wide coverage. Providers should develop key messages that are short and concise to enhance usage. Innovative approaches like developing demonstration farms within the village and using early adopters to popularize certain products could also be adopted.

3.9. Key Partners



Businesses, NGOs and government agencies were the key partner categories identified by the assessed ICT4Ag providers. Partnerships range from one (n=2 providers) to 5 (n=1 provider). Majority of the providers (n=5) have two categories of partners.



Most of these partnerships were meant to leverage on existing infrastructure and networks and acquire content.

The table below highlights the key partners for all the studied providers.

Country	Model	Businesses	NGOs	Govt.	MNO	Donors	Total categories of partners
Ghana							
Ignitia	Hybrid	x	x		x		3
mfarms	B2B		x				1
VOTO	B2B		x			x	2
Prep-eez	B2C			x	x	x	3
aWhere	B2B	x	x	x		x	4
Tanzania							
Agrlinsight	B2B	x		x			2
mFarming	Hybrid	x	x	x	x	x	5

Agrinfo	Hybrid	x		x			2
Bei Sokoni	Hybrid	x	x	x	x		4
RATIN	B2B	x	x	x			3
Kenya							
iShamba	Hybrid	x	x				2
Sokopepe	B2C	x	x				2
M-shamba	Hybrid			x			1
WeFarm	B2B	x	x		x		3
NAFIS	B2C	x		x	x	x	4
Total providers associating with each type of partner		11	10	9	6	5	

Tanzanian and Kenyan providers (n=5; n=4 respectively) have majority of business partners. All Tanzania providers have partnerships with government compared to only two each for Kenya and Ghana. MNO partnerships are distributed evenly across the countries.

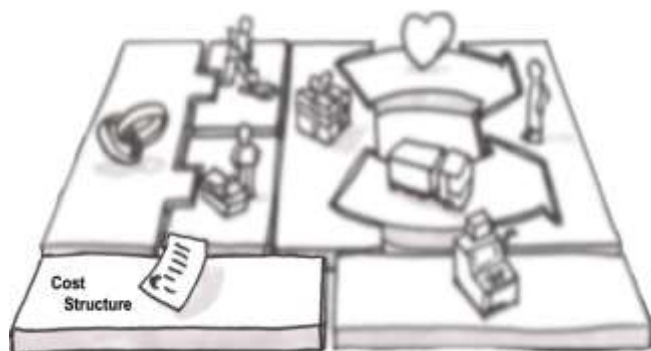
Partnerships with government denote political goodwill for the provider implying better prospects at least within the tenure of the government of the day. Partnerships with donors may only survive to the extent that the donor agenda and goodwill remains unchanged. ICT4Ag solutions have a history of collapsing owing to donor withdrawal or change of conditions. Depending on the number of donor partners, strong business partnerships could mean steady revenues and growth for the providers.

Discussions on how to sustain uptake and financial sustainability

Businesses, NGOs and Governments are the key partners. These partnerships may be enhanced through demonstration of value for key interest groups for these actors. On the other hand, providers should develop strategic partnerships with actors that add more value to them. This is because some partners may present unnecessary costs e.g. through requirement for reporting and involvement in activities that require use of more resources. Partnerships with research organizations present opportunities for development of content and leveraging on academic resources and to improve products and fostering new networks. Research partners may also present more credible, objective evaluation of programs compared to internal staff, who may be constrained by conflicts of interest. Government is an important partner that beyond granting required approvals for providers to operate enhances chances for them to be acceptable by some rural communities who trust government agencies.

Providers should establish partnerships which not only leverage existing resources such as talents, equipment, expenses, or crucial business relationships between parties; but also do not open them up to personal liability issues. The roles, duties and responsibilities of each player should from the outset be decided and made clear. The chosen partners should among others have complementary resources, create local brand recognition, increase the routes to market, and offer an opportunity to share brand equity and to cross-market to each brand's existing consumer base. This is while having in mind mutually strong reputations will strengthen the images of both partners while a poorly received partner may be detrimental.

3.10. Cost Structure



Except for M-shamba in Kenya, all providers have value-driven cost structures. This implies a deliberate strategy to identify their customers' needs and tailor their products to the customer's expectation. In the ideal situation, customers would respond by consuming and using more of these services.

Personnel and other operational costs consume the larger share of the expenditure of ICT4Ag solutions. SokoPepe and M-shamba had the largest personnel costs at 60% overall. Prep-eez had the highest administration costs (56%).

Discussions on how to sustain uptake and financial sustainability

Majority of the providers have value driven cost structures. They must as a priority, develop diverse products that add value to the already existing services. Providers may for example provide virtual advertising spaces on their web platforms, enhance customer care services etc. Markets have infinite opportunities; an important strategy is to see how best to shape the clients' perception of the products and improve their chances of paying for the services. This could be enhanced by better marketing strategies and improvement of quality of service. Expansion of paid up client base may in the long-run increase economies of scale and therefore spread the fixed costs.

Providers can sustain themselves by optimizing services of the workers and reducing operational costs. Providers should also scan their environments and identify other organizations that have competitive advantages in providing various services. They should also identify incentives for staff to optimize efficient work processes, retain talent and reduce turnovers that cost them directly as well as through lost opportunities.

Providers ought to minimize expenses at every opportunity and keep both capital expenditure (CAPEX) and operational expenditure (OPEX) cost elements low. It is particularly advisable to: license replicable and scalable platforms as opposed to developing a new one from scratch; and build partnerships with credible content providers, service providers, NGOs, and government agencies.

3.11. Conclusion

As highlighted in the table below, from our analysis, 12 solutions had not attained financial sustainability with only 3 of the 15 having fully broken-even.

ICT4Ag Provider	Country	Business Model	Years in business	Number of users	Break-Even Numbers (Year)	% towards financial sustainability
Ignitia	Ghana	Hybrid	3	80,000	150,000 (2018)	53%
mFarms		B2B	4	16	Broke-even in 2012	100%
VOTO		B2B	4	9,800	Broke-even in 2015	100%
Prep-eez		B2C	1	8,000	11,000	73%
aWhere		B2B	9	30	Broke-even in 2013	100%

Agrlinsight	Tanzania	B2B	3	2	350 license payers	1%
mFarming		Hybrid	3	5	10 (2018)	50%
Agrinfo		Hybrid	3	5,200		
Bei Sokoni		Hybrid	5	300,000	534,754 for USSD and 356,503 for SMS	34%
RATIN		B2B	10	-	-	<100%*5
iShamba	Kenya	Hybrid	1	350,000	800,000 subscribers (2018)	44%
Sokopepe		B2C	1	6,300	60,000 (2020)	11%
M-shamba		Hybrid	5	15,000	-	<100%*6
WeFarm		B2B	1	72,000	5 million	1%
NAFIS		B2C	6	60,000	-	<100%*7

The services that had fully become self-sustaining - mFarms, VOTO and aWhere - had the following common characteristics:

- Have adopted B2B business models: Their main customer segments are agribusinesses and other VCAs who pay for farmers to access the service.
- User fees are the main revenue stream.
- Have a variety of service offerings and can therefore diversify their risks, boost customer willingness to pay and increase their revenue streams.
- Utilize a combination of face-to-face and mass media to market their services
- Their platforms are copyright-protected
- Main partnerships are with NGOs and donor agencies
- Have been in business for 4 years and above to scale into the Growth and Established/ Maturity stages of the business life cycle.

3.11.1. Key performance indicators

Key performance indicators differed variably, depending on the product and customer segment of a provider. These are summarized in the table below:

Broad indicator category	Examples of specific indicators	ICT4Ag provider
Number of users	<ul style="list-style-type: none"> Number of subscribers Website unique visits and queries received Social media (e.g. Facebook engagement-views/ likes etc.) User retention rates Number of profiled farmers 	mFarms, VOTO, Ignitia, Prep-eez, mFarming, RATIN, Agrinfo, Agrlinsight, Bei Sokoni, WeFarm, Sokopepe, iShamba, M-shamba, NAFIS, and aWhere (n=15)

⁵ The continued offering of market information has been and will continue to be in the foreseeable future possible through financial support from development partners

⁶ Already attained on one service offering - "Farm system tool" with only 4 organizations on board - and expects to attain the same on the other two service offerings in 2017

⁷ NAFIS is government run and will continue to be in the foreseeable future run through financial support from development partners and the Ministry of Agriculture Livestock & Fisheries

	<ul style="list-style-type: none"> • Percentage Farmer listenership • Number of new users 	
Number of strategic partnerships	<ul style="list-style-type: none"> • Partnerships with financial institutions • Partnerships with diverse actors 	Sokopepe, mFarms, Bei Sokoni and Ignitia (n=4)
Services disseminated	<ul style="list-style-type: none"> • Agri- tips sent on time • Loans accessed from formal lenders • Number of customized platforms 	iShamba and Sokopepe (n=2)
Quality of query resolution	<ul style="list-style-type: none"> • Timeliness of information resolution • Accuracy of information disseminated • Number of queries resolved/ first call resolution 	RATIN and iShamba (n=2)
Trainings/capacity buildings	<ul style="list-style-type: none"> • Number of farmers trained • Capacity building activities 	Sokopepe and Prep-eez (n=2)
Increment in revenue/profits	<ul style="list-style-type: none"> • Profit margins • Earnings before interest and tax • Increased revenue • Cost savings using platform • Quick ratio 	Ignitia, mFarms, Agrlinsight and aWhere (n=4)
Impact	<ul style="list-style-type: none"> • Behavior change • Improved farming practices • % increase farm yields/ produce marketed • Successful transactions • % change of income 	Ignitia, Sokopepe, Prep-eez and M-shamba (n=4)
Customer feedback/ satisfaction scores	<ul style="list-style-type: none"> • Farmer satisfaction scores 	VOTO, mFarming, NAFIS and Bei Sokoni (n=4)

All 15 service providers based their performance indicators on the number of subscribers/users of their service. Variants of this indicator included new users, repeat users, and number of online engagements.

Other key performance indicators (KPI) include number of strategic partnerships with organizations that they could leverage on e.g. weather forecasting, financial institutions, mobile network operators, and community based organizations. Additional KPI included products disseminated e.g. number of agronomic tips sent to farmers (iShamba), loans accessed from formal lenders. Query resolutions were also used by providers like RATIN and iShamba. Customer feedback and propensity to recommend provider products and outcome of provider services on the users were also used to measure performance.

4. Conclusion and recommendations

Conclusion

The review revealed four stages of the business life cycle ICT4Ag solution providers go through. These include:

- a. Development / Seed Stage – this is where the idea is generated and a proof of concept is conducted through testing and piloting of the service (Lasts 2 years).
- b. Start-Up – business is incorporated, made legal and launched in market mostly through third-party support (from governments, donor agencies or private sector investors). Provider begins marketing and selling the services thereby establishing a customer base and market presence (Lasts 1 year). This is the stage in which most providers are in.
- c. Growth – Service is consistently generating revenue and acquiring new customers though it might be operating at a net loss or maintaining a healthy profit (Lasts 2 years). Most business models are proved to be ineffective at this stage and the ICT4Ag solutions eventually fail if the models are not re-evaluated.
- d. Established/ Maturity stage - Dominating presence in the market and slower growth. Service is able to generate and maintain profits. In this study, most of the solutions that had been in operation for over four years were financially sustainable.

Within the sample there was already a large overlap in terms of value proposition and key activity. However, the level of collaboration and exchange remains very limited.

The choice of business model has large implications on the expenses incurred by the solutions as it reflects on the CAPEX (Capital Expenditure) as well as the OPEX (Operational Expenditure), scalability, customer base and their attractiveness to potential investors.

Face-to-face marketing activities are still very important. Services with B2C business models in consideration of low media consumption, mistrust and low literacy rates of their smallholder farmer target population still have to rely on face-to-face marketing e.g. field agents to build trust and credibility among SHFs. It also helps boost referrals and strengthen the connection they have with the brand hence reducing the churn/ attrition rate (percentage of subscribers who discontinue their subscriptions within a given time period).

Revenue Share Model between MNOs and ICT4Ag providers remains to be a bone of contention. Most providers have difficulties in collaborating with Mobile Network Operators as the revenue split is often considered to be very biased, with the MNOs taking the larger share – 70 percent to 80 percent. This has been mostly attributed to the lack of an umbrella body to lobby for more favourable revenue sharing ratios that will increase the revenue that accrue to solution providers who are also important drivers for adoption.

Solid financial models that give the scale and depth necessary for providers to establish financial sustainability are a key element in the business models of ICT4Ag solutions. Financial models build forecasted financial statements including balance sheets, income statements and cash flow statements monthly for a period of three to five years thereby serving as an important tool for evaluation of business options and risks, business valuation, and scenario preparation.

It is challenging getting SHFs to pay for the full costs of ICT4Ag solutions. A majority of smallholder farmers are poor thereby have a very low ATP for agricultural non-financial services. This has made it challenging for providers to find the right pricing strategy for each service offering that will be both affordable to the end-users and generate profits for them. However, it is clear that there is a WTP for services in which they see enough value for instance if they make a profit by using the solution. For instance, Ignitia which charges Ghanaian SHFs USD 0.02 per forecast message arrived at their price point by looking at the price of other VAS services and working with the MNOs to understand that market, while also talking to farmers and using surveys to determine what a 'fair' price might be in terms of average farmer incomes.

Funding is a major constraint faced by agricultural non-financial service providers. In addition to bootstrapping, grants, and angel investors, awards are proving to be a significant alternative source of initial funding. This is depicted by the case study on WeFarm which has won over £800,000 in award money. In addition to being the launching pad for many ventures through funding and free consultancy services, awards are also instrumental in: sharpening the business models, preparation for pitches through refining value propositions, and raising brand-awareness.

There are little to no signs of consolidation in the ICT4Ag sector. Many solutions offer similar non-financial services (weather, agronomic and market prices information) yet there is poor cooperation among providers in the provision of these services to SHFs. The provision of ICT4Ag solutions in silos has led to increasing signs of difficulty in enrolling farmers onto new platforms with no major value difference from the earlier ones.

Most ICT4Ag solutions significantly rely on grant funding from donor agencies and NGOs. The grants are mostly used to subsidise the operational costs without much consideration of the long term viability of the solution and market distorting or catalysing effects of the grants. They also leave the solutions vulnerable to collapse whenever the funding window closes or donors re-examine their commitments.

Intellectual property (IP) which according to the World Intellectual Property Organization is divided into two categories: (1) Industrial Property (patents for inventions, trademarks, industrial designs and geographical indications) and (2) Copyright; is an important resource for ICT4Ag innovators. All the three countries covered by the study have IP laws which help convert ideas into IP assets. Most solutions are protected by copyright which are IPs that protect the expression of an idea. However, few had factored into their business strategies trademarks which provide exclusivity to the use of the brands (name, logo, colours or made up words) and patents which provide exclusive rights for inventions. This makes them susceptible to imitation by competitors, loss of reputation, lesser opportunities to find investors and access capital, and narrower non-monetary strategic choices (e.g. freedom to operate, collaborations, open innovation).

Financial KPIs as indicators of sustainability are particularly disregarded by agricultural non-financial service providers who mostly rely on sales and adoption metrics to assess their performance. Some of these poorly adopted KPIs include: Operating Cash Flow (measure of how well current liabilities are covered by the cash generated by operations); Current Ratio (ability to pay all debts over a given time period); Quick Ratio/ Acid Test (capacity to meet any short-term financial liabilities, such as upcoming bills); Net Profit Margin (profits generated on each dollar of revenue brought in through sales); and Customer Satisfaction metrics. The disregard of these metrics results in lesser focus on long-term financial performance and poor analysis of the financial health of the solutions.

SMS, USSD and IVR are the most preferred technology channels for delivery of non-financial agricultural services. This is primarily due to the cost of deployment with SMS being the lowest followed by USSD, IVR, website/ web-portal and call centres. Other guiding factors include literacy levels (both language and technical), content being delivered (complexity and type) and scalability.

Recommendations

The interviews with service providers, secondary data research and discussions held during the presentation of the research findings yielded a wealth of ideas for improving the sustainability and uptake of the solutions, which are presented below. However, more research is needed on this topic and a list of recommended sources for additional reading is highlighted in Annex D below.

1. Farmer level

1.1. Improved financial sustainability

- a. As most farmers have a low ability to pay influenced primarily by a low level of disposable income, service providers need to evaluate whether a freemium model would be a viable strategy to drive revenue and lead generation through trials. This is whereby focus is placed on acquiring a large client database that access the service for free to demonstrate the value of the service to, after which a paid plan or premium package with an enhanced version of the service can be introduced. Such a freemium model is being in place for both mFarming and Agrlinsight.
- b. Service providers should guarantee the quality, relevance and timeliness of solutions they provide as well as a suitable and justifiable pricing model to increase the SHFs willingness to pay. Evidence from services such as Ignitia which charges USD 0.02 per forecast message demonstrates that farmers are willing to pay for information they consider relevant, practical and beneficial.
- c. To reduce the cost burden on SHFs by subsidizing the service, revenue can be generated from agribusinesses under B2B models and from farmers who are integrated in formal value chains and thus have a higher ability to pay.
- d. Information solutions which farmers are not willing to pay for need to be bundled with other services e.g. credit access for which there is a high willingness to pay. Bundling in this case refers to the offering of two or more services as an integrated package

1.2. Higher uptake

- a. Local languages and agro-climatic characteristics in specific geographies should be considered in service delivery to make the content practicable
- b. A user-centred design approach should be used to guide decisions on the service design, delivery channels, a persuasive value proposition and formats for content delivery.
- c. Customer feedback is key for efficient service delivery and customer retention. ICT4Ag providers should put in place structured mechanisms to collect insights from clients at least annually.
- d. To build trust and promote a better understanding of the value proposition more personal and engaging marketing strategies should be used to reach end users. Face-to-face interactions through field agents are crucial in demonstrating the platforms and their value. Alternatively, using early adopting farmers as sales agents paid on performance basis might turn out to be cheaper than using staff.
- e. Agricultural labour mostly consists of women therefore the gender gap in mobile ownership should be considered during the design, content generation and marketing stages of the solutions
- f. Better protection of data privacy, opt-out possibilities and content quality validation are all important (regulatory) issues, which might reduce the mistrust and scepticism prevailing at farmer level

2. Service provider level

2.1. Improved financial sustainability

- a. ICT4Ag providers must consider how best to leverage on MNO platforms without compromising on getting an equitable revenue share percentage; which in most cases is in favour of the telecom operators justified by their large subscriber bases and

control over billing. Concerted efforts of ICT4Ag providers might improve negotiation power.

- b. Providers should avoid spreading themselves too thin by diversifying into a variety of service offerings that they find hard to commit to. Business growth needs to be a smooth and gradual process to allow for the key resources to be well developed to cope with demands that come with expansion
- c. Key performance indicators such those for sales (product/ service performance, sales per field agent, sales target and average profit margin), marketing (brand awareness, online conversions, cost per lead and purchase funnel), and financial, are necessary to define and measure progress towards achieving objectives or critical success factors. These quantifiable metrics should be regularly updated and monitored to guide the making of timely decisions and shed light on the way different users interact with the service.
- d. For the sustainability of the services that rely on subscription revenue, alternative revenue streams need to be sought out since most of the services offer what can be termed as “public goods” e.g. market information which has the two characteristics of public goods: non-excludable (cannot be provided without it being possible for others to enjoy) and non-rivalrous (use by one individual does not reduce availability to others). These include advertising and data analysis, and report generation.
- e. Providers should consider monetizing the large customer databases to other players in the agricultural value chain e.g. input suppliers and microfinance institutions is an alternative revenue stream that is often mentioned but not yet proven. Data quality and use cases need more attention in order for this revenue stream to come through.
- f. Symbiotic partnerships through signing of memorandum of understandings and/or Strategic Business Agreements should be sought out with other service providers (not necessarily direct competitors) to strengthen systems, cut costs, support dissemination of the services to a wider audience and share competencies for synergistic purposes.
- g. Providers, particularly those that are yet to break-even, should keep their operational costs low and avoid spending their limited financial resources on auxiliary expenses such as expensive rent and bloated workforce but instead opt for building the primary business model based on the service offering. This is with particular focus on knowledge and intangible assets.
- h. Awards can be a good source of initial seed funding, free consulting services, mentoring, and incubation. This is considering funding from traditional sources such as overdraft facilities, bank loans, venture capital and public or private grants remain inaccessible for most ICT4Ag providers.

2.2. Higher uptake

- a. Adopt a group marketing strategy as opposed to approaching individual farmers. For instance developing marketing campaigns targeting farmer groups and associations.
- b. To avoid focusing on the wrong customer segment, providers should ideally profile their users and have a strategy that concentrates on serving the majority who economically inhabit the bottom of the pyramid.
- c. Thorough market research is critical in assessing demand and identifying: clients and their needs, existing competitors, and pricing strategies both before and after offering ICT4Ag solutions. This is with the aim of being and remaining relevant in the market without necessarily re-inventing the wheel. The developed solution should then also focus on cost-effectiveness and sustainability after identifying, sizing and locating the users.
- d. The information provided should not be too complex and through user testing which is also crucial in gauging end-user literacy levels; providers should identify key words that simplify information extraction.
- e. Providers should identify best delivery channels by considering the content being delivered, cost of deployment, user technical literacy and scalability to ensure failed deliveries do not result from service side issues

3. For donors

3.1. Improved financial sustainability

- a. Consider investing in solutions that have measured their potential or present impacts and have robust financial models that identify their break-even points – period and scale at which revenues generated will cover the expenses
- b. Conduct in-depth analyses of business models before supporting solutions. The models must demonstrate a strong business case for the target customer segments to scale into financial sustainability
- c. Encourage cooperation – both vertical and horizontal - and consolidation in the sector to generate synergies (e.g. resource pooling and knowledge-sharing) and improve the sustainability of solutions
- d. Awards can filter ideas to expose the more developed ones hence providing a huge leap into moving towards scaling of the products

3.2. Higher uptake

- a. Focus on programs that raise awareness and implement change management in users' organisation to enhance adoption of new technology.
- b. Take a sector approach by promoting quality and client protection standards for solution provision in order to improve the trust in and uptake of ICT4Ag solutions.
- c. Promote existing ICT4Ag solutions alongside other interventions in the agricultural and smallholder promotion area.

Annex A: Service provider interview guide

1. Introduction

- Tell us about yourself and “insert enterprise name”
- What problem is this project trying to address?
- What is the proposed solution?
- At which stage of growth and possibly stage of funding is the service currently in? e.g. concept, prototype, early revenue, seed funding (break-even point), growth, and expansion
- Can you expand upon the transition between the concept phase and the current phase?
- What awards or honours has your solution received, if any?
- What have been your achievements this far?

2. Customer segment

- Which people or organizations does your business aim to serve?
- Who are your most important customers?
- What is the percentage of users at each stage of the customer journey i.e. registered, trial, and repeat?
- What do you consider to be the barriers to uptake?
- (Only if operating in multiple countries) Which country has the most users? Do these users primarily communicate with one another, or with farmers of other countries?

3. Value Proposition

- What type of non-financial services are you providing?
- From which sources do you get the content from?
- What is the business case for each actor involved (farmers, value chain actors, and financial institutions)?

4. Channel

- How are you reaching your customers e.g. website?
- What are the main transactions your firm engages in?
- Which transactions are supported or enabled via the channels of the value network, and which services are exchanged during these transactions?
- How are the channels integrated?
- Which channel works best and which one is cost efficient?
- How do you raise awareness about our company's services?
- How do you help customers evaluate your organization's Value Proposition?
- How do customers purchase the services you offer?

5. Customer Relationship

- Which types of customer relationships have you established e.g. personal assistance, automated services, co-creation and member communities?
- How is business development performed to lead to customer acquisition?
- How many active users do you have? Who qualifies as an active user? How has been the growth of monthly active users been over the last quarter?
- What is the customer retention rate e.g. how many users defect/respectively join the user base?
- How costly are the relationships established?
- What percentage of subscribers are repeat users?
- How are the relationships integrated with the rest of your business model?
- What mechanisms have you put in place to boost sales?
- How strong would you say you brand (what differentiates you from your competitors) is?
- What would you consider to be the major challenges inhibiting the use ICT in disseminating non-financial agricultural solutions?

6. Revenue streams

- Which type of pricing mechanism is in place for the individual service offerings?
 - One-time customer payment
 - Recurrent payments
- How much do customers pay for the different service offerings?
- How much does each revenue stream contribute to your overall revenues? E.g. usage fee, advertising and subscription fee
- What ways do you use to generate revenue?
- What have been your revenues and profits in the past 3 financial years?
- Do you have a financial model which gives information on the scale and depth necessary for financial sustainability? If yes, at what scale and depth should and can you realise in order to establish financial sustainability?

7. Key Resources

- Which key physical resources do you have?
- Which intellectual resources exist? e.g. brand, patents and copyrights, partnerships, websites, and customer databases
- What human resources does the business currently rely on? E.g. sales, software developers, website designers, agronomists
- What is the current number of employees – temporary and permanent?
- How many clients do you currently have for each service offering?
- Does the business leverage on any financial resources e.g. lines of credit?
- What key resources are required by your revenue streams, distribution channels, value propositions and customer relationships?
- How are resources and capabilities used to create products, attract customers and drive value creation in a self-sustaining feedback loop?

8. Key activities

- Which activities dominate your operations e.g. platform maintenance, marketing, logistics?

9. Key Partnerships

- Who are your key partners?
- What was the motivation behind creating each partnership e.g. reduce costs, reduce risk, access clients or acquire knowledge?
- Which key resources are you acquiring from the partners?
- Which key activities do the partners perform?

10. Cost structure

- What are the most important costs you incur during operation e.g. personnel, marketing?
- What is the average cost you incur to deliver each service?
- What are the customer acquisition costs?
- Which key resources are most expensive?
- Which key activities are most expensive?
- Which cost structure has been adopted e.g. cost-driven or value-driven?

11. Conclusion

- What scale should you realize for your services to be delivered sustainably?
- What is the impact of the work to date? Also describe the projected future impact
- Which Key Performance Indicators (KPIs) are you using to analyse your business success?
- What is this solution's plan to ensure this initiative's financial sustainability?
- In your opinion, can the “insert service name” business model be scaled up?
- What challenges have you faced in the delivery of your service?

Annex B: Key informant interview guide

1. Introduction

- Kindly introduce yourself and tell us about your involvement in the delivery of ICT based agricultural services to smallholder farmers
- What non-financial problems face small-holder farmers in the region?
- What are rural farmers in sub-Saharan Africa's current attitudes towards their mobile phones?
- What elements, in your opinion, would you say are critical to a viable and sustainable mAgri business model?
- What has really worked and what mistakes have commonly been made by service providers? Why do you feel that way?
- What do you think have been the keys to successful mobile agriculture endeavours? Why do you feel that way?

2. Customer segment

- How would you suggest providers set up user research to ensure that farmers' voices and their ecosystem are integrated into the mAgri service?

3. Value Proposition

- How can the design for mobile agricultural services be enhanced?
- Which factors would you say need to be considered and put in place to guarantee a successful product?
- What attributes should the agricultural content developed by mAgri services have in order to be valuable to farmers?

4. Channel

- Which, in your view, are the best-suited technology delivery channels for the target markets in Kenya, Ghana and Tanzania?
- What are the advantages and disadvantages of each of using each of the following delivery mechanisms – SMS, IVR, Mobile application, Call center, and USSD?
- How can ICT mediums be combined for greater awareness and impact?

5. Customer Relationship

- What are the contributing factors that have led to existing mAgri services gaining little traction with farmers and how can they be overcome?
- How can providers better connect the mAgri services with the needs of farmers and other key actors in the ecosystem?
- What methods can be used to incentivize users – both potential and existing – into using the mAgri services?

6. Revenue streams

- Considering the high price sensitivity of the target market, how can service providers reduce their dependency on donor funding and achieve financial sustainability?
- How can providers develop a business model that allows them to balance costs and revenues of the product sustainably?

7. Key activities

- Which viable marketing strategies, including both above-the-line (ATL) and below-the-line (BTL) marketing, could service providers implement to enhance sustained outreach (high % of active users and client retention)?

8. Key Partnerships

- Before entering into partnerships, what should service providers consider?
- Which fundamental partnerships should mAgri service providers consider forming and why e.g. mobile network operators (MNOs)?

9. Cost structure

- In order to improve their profitability, how can providers minimize the costs associated with delivering the agricultural services?

10. Conclusion

- From your knowledge and experience, how can service providers effectively identify the required scale and depth that services should and can realise in order to be delivered sustainably?
- What should service providers consider doing to improve the quality of non-financial services offered and the value proposition?
- What challenges face providers in the delivery of non-financial services e.g. information solutions, supply chain management solutions and trading platforms; and how can they overcome them?
- Which opportunities exist for service providers offering non-financial agricultural services e.g. rich media services?
- What pitfalls should ICT based agricultural solutions providers avoid to guarantee the sustainability of their business models?
- Any remarkable non-financial solutions innovations you have come across in the target countries? If yes, what differentiates them from their peers?
- Is there anyone else you would suggest we also interview with regard to the study topic?

Annex C: List of interviewees

Expert interviews

Name	Title	Organization
Matthew Shakhovskoy	Director	The Global Development Incubator
Natalia Pshenichnaya	Head of mNutrition, comprising of mHealth and mAgri programmes	The GSMA

ICT4Ag provider interviews

Name	Title	Organization
Kenya		
Kenneth Ewan	CEO	WeFarm
James Nguo	Director	Sokopepe
David Campbell	Director	iShamba
Omondi Okello	CEO	M-Shamba
Adul Ochieng	Chief Agricultural Officer	NAFIS
Ghana		
Stewart Collis	Chief Technical Officer	aWhere
Garcia Honvoh	Business Development Manager	mFarms
Collins Boakye	Project Manager	VOTO
George Arthur-Sarpong	Director of technology	
Lizzie Merrill	Project manager	Ignitia
Duke Ofosu-Anim	Head of Project M&E	Prep-eez
Tanzania		
Uwe Schwarz	CEO	mFarming
Janet Ngombalu	Regional Manager: Marketing Information and Communications	RATIN
Rose Funja	CEO	Agrinfo
Patrick Guyver	CEO	AGRIinsight
Dr. Richard Toba	CEO	BR Solutions

Annex D: Bibliography and recommended reading list

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