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AG-PLATFORMS IN EAST AFRICA

National and regional policy gaps

Aarti Krishnan, Karishma Banga and Joseph Feyertag

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ODI AGRITECH REPORT SERIES

ODI is releasing a series of reports funded by the Enhanced Integrated Framework that aim to explore AgriTech in East African value chains, as detailed in the below table. This current document is Report 3.

ODI AgriTech Report Series

Report	Report brief
Report 1: Disruptive technologies in agricultural value chains: Insights from East Africa	This conceptual paper explains what disruption means within AgriTech, along with who is disrupted and how. It also alludes to how to such disruption can create various pathways to value capture and creation.
Report 2: Platforms in agricultural value chains: Emergence of new business models	This report aims to explain the various models of Ag-platforms that exist and provide policy-makers with a roadmap that supports the proliferation of sustainable Ag-platforms.
Report 3: Platforms in agricultural value chains: National and regional policy gaps	This report aims identify the various national and regional policies required to ensure the proliferation of Ag-platforms and consequently ways to use Ag-platforms to bridge national and regional policy gaps.
Report 4: Ag-platforms as disruptors in Ugandan value chains: Pathways to value capture	This report uses survey data to explain the causal factors that have impacts on productivity, value addition, diversification, women's empowerment, youth inclusion and regional trade facilitation in Uganda.
Report 5: 10 policy interventions to implement within the East African Community	This report provides a list of the 10 key interventions that donors can invest in, in order to maximise the value creation and capture the potential of Ag-platforms for the poorest.

LIST OF ACRONYMS

1AF	OneAcre Fund
3Cs	Costs, Complexity and Capabilities
AfDB	African Development Bank
AFR	Access to Finance Rwanda
AI	Artificial Intelligence
CAADP	Comprehensive Africa Agriculture Development Programme
DAP	Digital Ambassadors Programme
DFID	UK Department for International Development
EAC	East African Community
EAC-BIN	EAC Broadband ICT Network
EACO	East African Communications Organisation
EAPS	East African Cross-Border Payment System
EBA	Enabling the Business of Agriculture
ERP	enterprise resource management
EU	European Union
FAO	Food and Agricultural Organization
FOE	Friends of the Earth
GDP	gross domestic product
GIZ	German Development Corporation
GLTN	Global Land Tool Network
GPS	Global Positioning System
ICT	information and communication technology
IP	intellectual property
IP	Internet Protocol
IPR	intellectual property rights
IoT	Internet of Things
ISDA	Innovative Solutions for Decision Agriculture
ISP	internet service provider
ITC	International Trade Centre
ITU	International Telecommunication Union
MAAIF	Ministry of Agriculture, Animal Industry and Fisheries
MCI	Mobile Connectivity Index
MINAGRI	Ministry of Agriculture
MINICOM	Ministry of Commerce
MIS	Management Information System
MNO	mobile network operator
MSEs	micro and small enterprises
MVNO	mobile virtual network operator
NAADS	National Agricultural Advisory Services
NARO	National Agricultural Research Organisation
NBI	National Backbone Infrastructure
NCIP	Northern Corridor Integration Projects
NGO	non-governmental organisation
OECD	Organisation for Economic Co-operation and Development
ONA	One Network Area
R&D	research and development
SACCOs	Savings and Credit Cooperatives
Sida	Swedish International Development Cooperation Agency
SMS	Short Message Service
SQMT	Standardisation, Quality Assurance, Metrology and Testing
STEM	science, technology, engineering and maths
SWC	Severe Weather Consult
TRIPs	Trade-Related Aspects of Intellectual Property Rights
TVET	technical and vocational education and training

UK	United Kingdom
UNCTAD	United Nations Conference on Trade and Development
UNECA	United Nations Economic Commission for Africa
USAID	US Agency for International Development
USSD	Unstructured Supplementary Service Data
VAT	value added tax
VoIP	Voice over Internet Protocol
WEF	World Economic Forum

EXECUTIVE SUMMARY

This report aims to discuss how various business models of Ag-platforms can be used to bridge national and regional policy gaps in East Africa, drawing on case study evidence from Uganda and Rwanda. Section 1 highlights the multiple value creation and capture opportunities as compared with traditional value chains. These include Ag-productivity gains; value addition and diversification; creation of more, decent and formal jobs for youth; gender inclusion; and knowledge accumulation and absorptive capacity. However, without the ‘right mix’ of policies, Ag-platformisation through the 3Cs of Costs, Complexity and Capabilities may exacerbate existing inequalities rather than supporting value creation for the poorest.

Section 2 zooms in on East Africa and compares East African countries in terms of digital and regulatory readiness. We find that Kenya ranks ahead of other East African countries on the GSMA Mobile Connectivity Index (MCI), followed by Rwanda, Tanzania and Uganda, and also leads in terms of digital readiness of the agricultural sector. However, there is a significant digital divide across gender and information and communication technology (ICT) skills in East Africa: only 17% of students pursuing degrees in science and technology subjects in Kenya are women, 24% in Tanzania and 18% in Uganda (WEF, 2017). Regulatory readiness also varies significantly across these countries, especially in terms of conversion of draft laws into implementable acts/laws or protocols. Each of these aspects – ICT practices and authorities, mandates and competition frameworks – sets the landscape for supporting the development of Ag-platforms within each country. Rwanda is found to rank lower in regulatory readiness but is doing better than other East African countries on e-commerce regulations, having an active legal framework on electronic transactions, data protection, consumer protection and cyber-crime prevention.

Section 3 lays out a typology of Ag-platform models. It presents five models of Ag-platform delivery across a value chain, which consists of a combination of various scopes (breadth of functions and processes) and scales (destination of final product). It is important to note that each Ag-platform model’s uptake is linked to the 3Cs and can vary depending on the country context. These models are as follows:

1. The *production and exchange model* consists of three scopes: backward exchange, horizontal offers and information services, whereby farmers gain production-related information, sometimes along with Artificial Intelligence (AI) and big data analytics support, generally at the pre-production and production stage of the value chain.
2. *Output exchange* occurs midstream in the value chain, consisting of three scopes: forward exchange, post-harvest and information services. This is an auction-based model, wherein farmers are provided information on crop prices and on logistic prices to transport products, as well as post-harvest services such as grading and packaging.
3. *Trading and sharing* consists of five scopes: marketplace matching, horizontal offers, information services, complex information services, production and harvest services, and sharing and knowledge exchange. This model covers the full value chain, as it includes services from the pre-production stage to the output sale.
4. *Guarantee purchase and logistics* consists of two scopes; guaranteed purchase and prices, and information services. In this case, Ag-platform firms act as intermediaries and buyers, by taking the onus of loss onto themselves. They provide farmers with contracts, along with a guarantee of purchase at specific market defined prices.
5. The *single buyer-integrated* model works within a completely vertically integrated value chain, wherein the main off-taker, be it a processor or a retailer, directly controls the entire value chain and there is already a predetermined market.

The section applies the business models to Uganda and Rwanda. Data collection in Uganda involved interviews with over 35 stakeholders conducted in July 2019. These included representatives of 10 Ag-platform firms, cooperatives, national and sub-national governments, international donors, universities, non-governmental organisations and farmers. Data were collected in Rwanda from over 20 stakeholders and 12 digital Ag-platforms operating in the country.

Findings suggest that, in Uganda, 50% of the apps are *production- and exchange-related*; this is followed by 20% in *trading and sharing* and one for *output exchange* and *single buyer-led*, respectively. None of

the apps reviewed (or that were known to government/other app developers) related to *guaranteed logistics and purchase*. Overall, the results suggest that adoption rates increased most in production and exchange models because of relatively low costs and the lower complexity of product and capabilities required. Much of the change in trading and sharing models was driven by significant support from donors, the hands-on approach of the Ag-platform staff and the significant expansion of the app in urban and peri-urban farming. This led to a high rate of adoption despite its higher costs and capabilities. Trading and sharing platforms showed the most improvement in terms of productivity, value addition/diversification, number of jobs created and gender inclusion; it was followed in this by production and exchange, single buyer-led and output exchange.

While the platforms have created only a low number of new jobs, in almost all cases there has been some level of change experienced in relation to the formalisation of jobs, with a large number of new bank accounts opened and written contracts provided to farmers for products, which in turn has provided farmers with better credit/loan facilities for working capital. There is a clear trend of low female participation/gender inclusion on Ag-platforms, because of the lack of mobile phones (e.g. the male member in the family owns and uses the mobile phone).

Unlike Uganda, Rwanda has many more government-supported apps and projects, run by the Ministry of Agriculture and the Ministry of Commerce. A range of value capture opportunities has emerged, which have grown through the use of Ag-platforms. Almost all *production and exchange* platforms reported an increase in crop yields, and a higher number of jobs being created, especially in the app itself (hiring of extension officers, new staff). At the same time, however, research across Africa shows that upskilling and more efficient monitoring and management can reduce the need for human interface, as AI can be used in its place, reducing the overall costs of labour employed. Similar results were shown in the key *trading and sharing* models. Another important improvement to note is the steady change towards gender inclusion in Rwanda.

Sections 4 and 5 explore the potential of Ag-platforms to act as a bridge for national policy gaps in the short term. Trading and sharing and production exchange Ag-platforms come out on top when it comes to bridging national policy gaps related to fiscal and institutional policy. Guaranteed purchase and logistics models of Ag-platforms would work successfully to fill infrastructural deficits of road and rail and take all the risks onto them to transport and sell farmers produce. Similarly, trading and sharing platform come out on top when it comes to filling deficits with regard to lack of governmental support to up-skilling, by providing capacity-building themselves and supporting knowledge spillovers through peer-to-peer chats that fall outside the remit of the transaction tax.

However, the lack of implementation of national policy, and the increasing gaps between national policies and business functioning can create several challenges for Ag-platforms, and threaten their survival. For instance, almost all platforms reported that lack of support from the government – lack of subsidies, high costs of borrowing, absence of formal banking and low research and development investments – had led to significant distress, inhibiting their sustainability. Within infrastructural gaps, poor network coverage, lack of digital infrastructure investments and poor warehousing were mentioned as common problems. Further regulatory gaps, such as unclear laws on data, which prevents Ag-platforms from sharing such data; lack of local servers, increasing the costs of data storage; and high costs of using payment systems, have forced many Ag-platforms to reduce the remit of the services they were able to provide.

Finally, unclear land ownership titles and inability of farmers to form strong and well-functioning cooperatives were also seen as a significant challenge to the adoption of Ag-platforms. Lack of government support in the provision of digital training is another issues. However, one of the most important factors impinging on the sustainability of an Ag-platform is the lack of coordination between government agencies. The report also finds that 98% of all platforms within the East African region exist only within national boundaries. This points to the need to understand the various regional policy gaps that prevent the proliferation of apps regionally. Creating more comprehensive Ag-e-commerce regulations, with complementary actions on regional ICT skilling, may boost regional e-commerce.

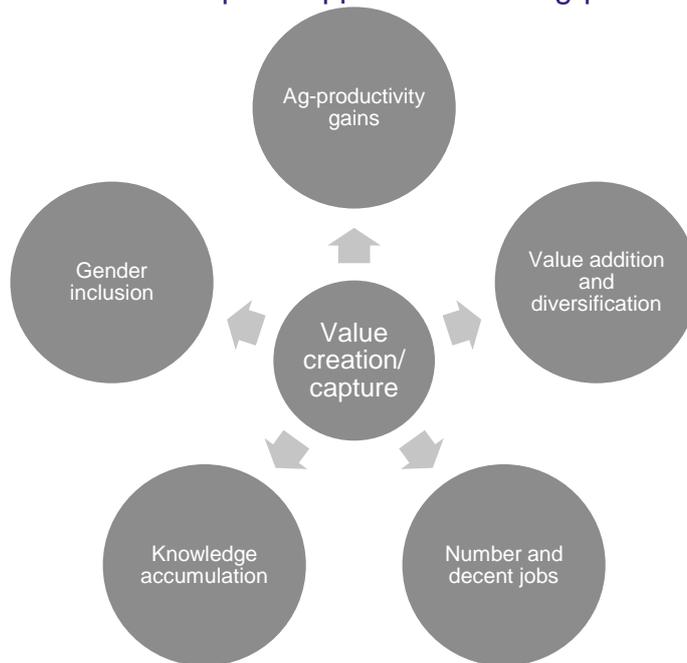
The final section provides a roadmap for policy-makers to develop sustainable Ag-platforms that engender value capture maximisation and act as an effective bridge of policy gaps. Thus, the various business models of Ag-platforms developed, and the related policy deficits, can be matched to policy goals, in order to create win/win opportunities for the poor.

1. INTRODUCTION: AG-PLATFORMS AND NEW VALUE PROPOSITIONS

The growth of the platform economy, within agriculture, is increasingly becoming an important pathway to development. In the context of Sub-Saharan Africa, this is critical as, according to Cleland (2017), about 65% of the population relies on farming and about 20% on the non-agricultural informal sector; only around 15% are wage earners working in services and less than 3% are employed in industry. Agricultural digital platforms (such as farming apps) are driving e-commerce and the servicification of agriculture in developing regions. Côte d'Ivoire, Ghana, Kenya, Nigeria, Senegal, South Africa, Uganda and Zimbabwe have been described as hotspots for digital-tech solutions (GSMA, 2018). Of these, Ag-platforms, or farming apps, are some of the most common forms through which farmers have been 'platformised' in agricultural value chains. Our research paper on 'AgriTech Disruptors in East Africa' shows that, of a sample of 70 AgriTech innovative firms (e.g. Ag biotech, Precision Ag and robotics, innovative food and data-connected agriculture) in 2018 in the East African Community (EAC), between 66% and 86% of firms specialised in data-connected agriculture – that is, farming apps or providing enabling services for app development (Krishnan et al., 2020).

Participating in Ag-platforms may create new *value creation and capture opportunities*. Figure 1 illustrates these.

Figure 1: Value creation and capture opportunities of Ag-platforms



Source: Authors' construction

Ag-productivity gains: This has economic implications in terms of increased income or asset accumulation, along with improving the efficacy of factors of production. Agricultural productivity increases required to sustain overall economic growth need to be based on increased technical or financial efficiency of use of inputs and factors such as fertiliser, labour and land, or technological progress that makes it possible to produce more with less – or all three (World Bank, 2018).

Value addition and diversification: This creates opportunities for specialisation in agricultural value chain functions, and diversifying agricultural functions beyond on-farm labour, value-added functions can include downstream activities, such as marketing, branding and/or sophistication and quality improvements through processing.

Creation of more, decent and formal jobs for youth: A key value creation opportunity relates to adding more youth into the labour force. Data suggest that Africa needs to create about 12–15 million jobs to absorb the youth entering into the market annually (Gough et al 2013).

Ag-platforms can boost youth inclusion in two ways. The first is as developers of Ag-platforms through the use of their digital (information and communication technology (ICT) skills) and soft skills, which thus hones their entrepreneurial skills. The second relates to encouraging youth to return to agriculture as ‘smart farmers’ and to use digital technology in farming practices.

Gender inclusion: Ag-platforms have the potential to reduce the gender gap in relation to slimming persistent gender digital divides, through improving access to receiving digital skills, finance/credit and work opportunities, reducing information asymmetries and training gaps, and supporting the creation of a level playing field. Another benefit claimed is increasing efficiency through matching demand to supply, thus enabling women to spend more time on non-work activities (e.g. reproduction, rearing of children).

Knowledge accumulation: Ag-platforms can engender the ability of farmers to harness and mobilise new forms of knowledge. While their adoption can be a complicated process, they have the potential to improve the overall quality of the processing of new knowledge/information and its effective absorption in order to better prevailing work practices.

While Ag-platforms offer multiple sources of value creation, several challenges also emerge. As we point out in our paper on Ag-disruptors in East Africa (Krishnan et al., 2020), Ag-platformisation through the 3Cs of Costs, Complexity and Capabilities may exacerbate or reproduce existing inequalities rather than supporting value creation. For instance, the high costs of running a platform may push costs onto farmers who are unable to pay for services. These costs could be considered sunk costs (incurred costs that cannot be recovered), as they are necessary to upgrade existing processes of doing business. Overall, these costs may inflate both the input costs (e.g. purchasing of specific chemicals) and the running costs (e.g. cost of gaining information, using services) to farmers. In some cases, high costs may compound gender divides by further reducing access and affordability to new technologies (ibid.).

The second and third overarching challenges comprise complexity and the related capabilities needed to adopt Ag-platforms. Complexity occurs if the Ag-platform has a high technological intensity and relate to the extent to which the embedded complex information and knowledge is transmitted to users of the platform. Farmers with lower capabilities – that is, those with low digital skills to use new technology or those who are unable to merge old and new technologies for production, harvesting, quality control, operation and maintenance, and monitoring of productivity – may face significant barriers in the uptake and use of Ag-platforms. This reduces their comparative advantage and further marginalises them from participating in value chains (Krishnan et al., 2020).

Therefore, business models of Ag-platforms may vary significantly and the value proposition they offer to farmers and users may or may not be sustainable. However, it is important to understand the policy environment, by comprehending whether or not national and regional policies engender the proliferation and maximise the positive potential of Ag-platforms, and also studying the extent to which Ag-platforms can fill in gaps in policy arcing as a ‘bridge’.

This report aims to:

- Discuss business models of Ag-platforms, suggesting there are multiple varieties and functions provided by apps within agricultural value chains, and no ‘one-size-fits-all’ app;
- Identify the importance of Ag-platforms in value chains through exploring policy gaps that exist nationally (e.g. finance, infrastructure, land governance, cooperation and partnership) and discuss the ways in which Ag-platforms can possibly ‘fill’ or bridge these gaps, thereby facilitating value creation opportunities mentioned above;
- Identify policy gaps at the regional level (East Africa) linked to trade facilitation (harmonisation of standards, ease of movement of capital, labour, e-commerce), data infrastructure, finance and

mobile payments, cross-border logistics and traceability. Designing smart regulation in these policy spaces can support the proliferation of Ag-platforms regionally;

- Identify which Ag-platform business models could work best to fill/bridge the various policy gaps at regional and national levels, as well as the models that work best to maximise value creation opportunities of increasing Ag-productivity, value addition, increasing the number of jobs (formal and decent) for youth, supporting gender empowerment and enabling the entrepreneurial capability of youth. This is conducted through case studies of Uganda and Rwanda, in addition to country comparisons with Kenya and Tanzania. The agriculture sector is also a major contributor to gross domestic product (GDP) in the case of Burundi (34.2%) and South Sudan (34.5%); however, these countries are largely excluded from the analysis owing to limited availability of data on digitalisation of the agriculture sector;
- Develop a roadmap for policy-makers by highlighting the need to use a 'modular' process (adding scope and scale in a progressive manner to create customisable apps to achieve the desired objective) of developing an Ag-platform that fulfils various value creation opportunities as well as bridging policy gaps. This will create win-win sustainable solutions to the transformation of agriculture and resilience of livelihoods to the poorest.

The rest of the report is structured as follows. Section 2 presents the enabling environment for Ag-platforms in East African countries. Section 3 develops a typology of business models of Ag-platforms with examples from Uganda and Rwanda. For a detailed discussion on the business models of Ag-platforms refer to our paper in this series on 'Platforms in Agricultural Value Chains: Emergence of New Business Models'. The case study of Uganda uses 65 interviews and a survey of 825 farmers; that of Rwanda uses 20 interviews in 2019. Section 4 looks at the various national policy gaps, using insights from the case studies to suggest how Ag-platforms act as a bringing instrument to narrow these policy gaps over the short term, however, by not systematically filling these policy gaps, Ag-platforms begin to struggle to survive over the longer term. Section 5 identifies regional policy gaps and explains how filling these can support the growth of regional Ag-platforms. Finally, Section 6 summarises the research and provides a way forward for policy-makers through an Ag-platform roadmap

2. ENABLING ENVIRONMENT FOR AG-PLATFORMS IN EAC COUNTRIES

The building blocks of Ag-platforms are (i) hardware (e.g. ICT infrastructure, sensors, weather stations, irrigation hardware, agronomic diagnostic equipment, technology transfer); (ii) software and applications (e.g. Blockchain, Internet of Things (IoT), Voice over Internet Protocol (VoIP), data analysis, intellectual property source code, Artificial Intelligence (AI)); and (iii) data chains for decision support (e.g. data storage, data collection rules, data capture processes).

In this case, hardware refers to the machines, wiring and other physical components of an electronic and mechanical system, which range from supporting technology transfer in products such as sensors (for mapping to provide spatial and proximate information), to guidance hardware for accurately triangulating GPS and other connected devices or low-cost hyper-local weather stations and weather monitoring devices.

Software refers to applications – the predominant focus of digitalisation – such as improved broadband width; better VoIP for delivery of voice communications and multimedia sessions over IP networks; and technology transfer by IoT, which is a system of interrelated computing devices, mechanical and digital machines, objects, animals or people that are provided with unique identifiers and the ability to transfer data over a network without requiring human-to-human or human-to-computer interactions.

The third building block is the collection, storage and processing of data through complex software to support precision agriculture (Krishnan et al., 2020).

Together, these building blocks enable the upgrading of crop and farm practices; management and monitoring; syncing of hardware devices to mobiles; the collation of multiple streams of data related to the growth progress of crops; and the delivery of information on pests, diseases, weather, quality checks and financial and farm labour.

The building blocks require two key enabling factors – ‘digital readiness’ and ‘regulatory readiness’ – which can improve the overall enabling environment for the building blocks to thrive. The strengthening and growth of the building blocks in Ag-platforms will facilitate their proliferation and adoption. This section takes a deeper look at digital and regulatory readiness, at the national and regional (EAC) level, to gain a holistic understanding of the current enabling environment for Ag-platforms.

2.1 Digital readiness for Ag-platforms

Broadly, digital readiness for Ag-platforms refers to the ability of countries to develop, use and navigate digital platforms, which depends on enabling factors that include ICT infrastructure, rate of technology adoption, human capital, and business and government investment. At the regional level, the EAC Development Strategy 2006–2010 captures ‘Information and Communication Technology integrated into regional development initiatives’ as a development objective. In addition to mainstreaming ICT in all its programmes, the EAC has identified regional connectivity issues as a constraint to economic activity, and has therefore defined specific strategic interventions to address this, including implementation of a cross-border connectivity project and coordination and harmonisation of ICT policies (AfDB, 2013). Currently, the majority of the capacity connecting the region to global markets is supplied through submarine cables in Kenya and Tanzania, supplemented by small amounts of international capacity provided through cross-border terrestrial cables, as well as some satellite broadband capacity. The other four landlocked countries access international capacity through cross-border terrestrial cables, facing corresponding mark-ups in pricing. This partly helps explain disparities between existing national connectivity markets.

The EAC Broadband ICT Network (EAC-BIN) aims to address missing links and ensure that landlocked countries have access to the submarine landing stations at the same cost as coastal countries (AfDB, 2013). The EAC’s regulatory harmonisation has been more effective than that of other regions because of the small number of countries that participate in the coordinating body – the East African Communications

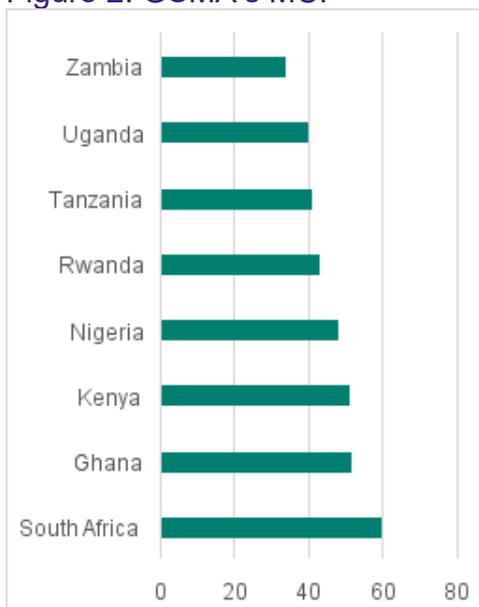
Organisation (EACO). EACO brings operators and regulators together, and has established interconnection guidelines and a model regional interconnect agreement (ibid.).

In 2014, the countries of the EAC also made a joint commitment to fast-track the creation of a One Network Area (ONA) to reduce high roaming charges and interconnection rates, which are significant barriers to cross-border communication (World Bank, 2018). The ONA, currently covering Kenya, Rwanda, Uganda and South Sudan, has introduced harmonised cap rates for cross-border traffic originating and terminating within participating countries, and the elimination of roaming surcharges for users travelling within the region (ibid.). In Uganda, retail roaming rates were cut from \$0.93 to \$0.10 per minute (based on figures from 2016) following introduction of the ONA; in Kenya and Uganda, cross-border voice traffic has tripled. However, despite the success of this initiative, plans to extend it to data, SMS and mobile money services have been slow to materialise (ibid.). These policies have prompted the growth of Ag-platforms by reducing the challenges of cross-border communication and roaming. Targeted initiatives that lower connectivity prices for consumers, such as the ONA, need to be prioritised and fast-tracked at the regional level. These initiatives also need to be fully extended to cross-border data exchange.

Focusing just on mobile connectivity, Figure 2 finds that Kenya ranks ahead of other EAC countries on the GSMA Mobile Connectivity Index (MCI), followed by Rwanda, Tanzania and Uganda. This index measures the performance of countries against the key enablers of mobile internet adoption: infrastructure, affordability, consumer readiness, and content and services.

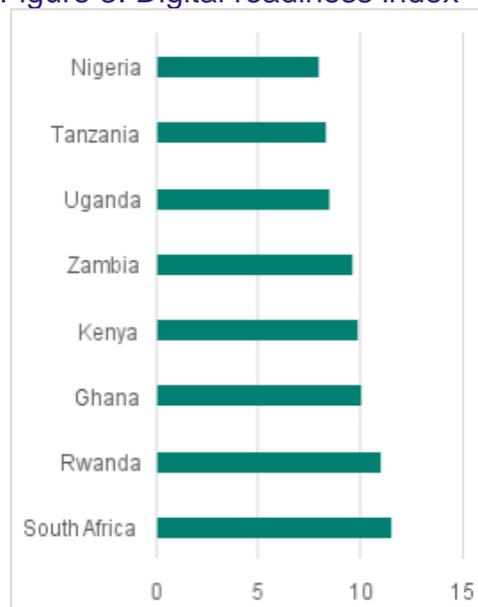
Figure 3 looks more broadly at digital readiness in EAC countries and compares these with other selected African countries on Cisco’s country-specific digital readiness scores. This index measures a country’s digital readiness along seven components: (i) technology infrastructure (fixed telephone subscriptions, fixed broadband subscriptions, internet services, networking services); (ii) technology adoption (mobile device penetration, internet usage, cloud services); (iii) human capital (quality of maths and science education, adult literacy rate, years of schooling, population aged less than 14 years); (iv) basic needs (life expectancy, mortality rate for those under five years, sanitation, access to electricity); (v) ease of doing business (overall ranking, rule of law, logistics performance, time to get electricity); (vi) business and government investment (foreign direct investment , high-technology exports, government success in ICT promotion); and (vii) start-up (strength of legal rights, time to start a business, availability of venture capital). Within the EAC, Rwanda ranks the highest on digital readiness, followed by Kenya, Uganda and Tanzania.

Figure 2: GSMA’s MCI



Source: GSMA MCI 2019

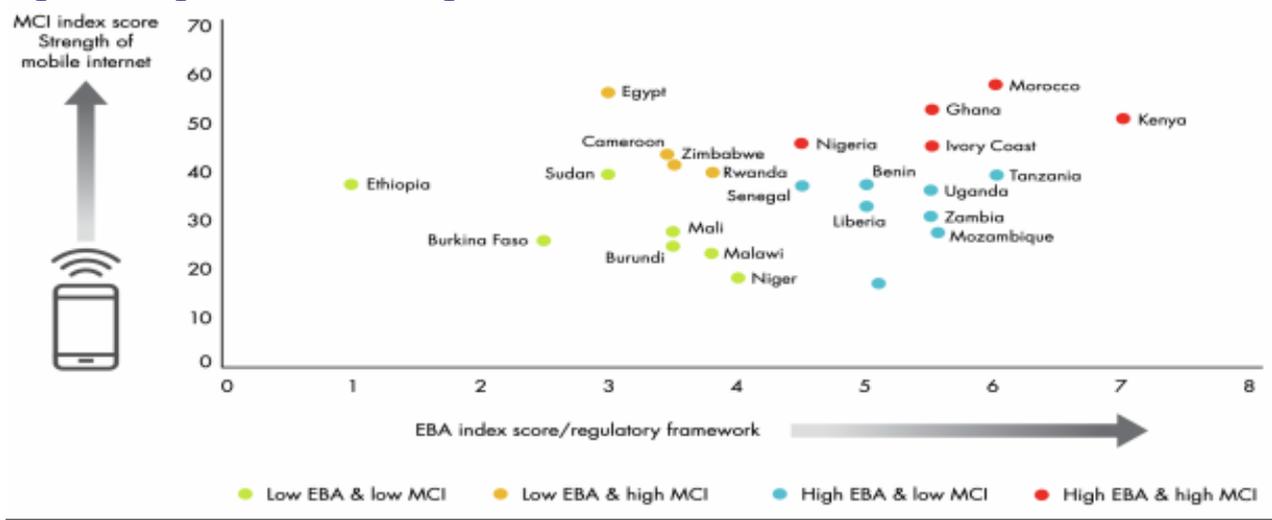
Figure 3: Digital readiness index



Source: Cisco Digital Readiness Index

While the discussion above captures the overall digital or mobile readiness of the country, Tsan et al. (2019) compare countries on the basis of use of technology in the agriculture sector (see Figure 4). Digital readiness in agriculture is mapped using data on overall mobile connectivity (GSMA’s MCI) in the country and on Enabling the Business in Agriculture (EBA) (World Bank). Kenya ranks the highest on digital readiness in agriculture: it has high EBA index and MCI scores. Tanzania and Uganda have high EBA but low MCI scores, whereas Rwanda has a low EBA score but a high MCI score. Burundi ranks low on both . Box 1 summarises lessons from Kenya on leveraging digital technologies for agriculture.

Figure 4: Digital readiness in agriculture



Note: Data are for 2017

Source: Tsan et al. (2019)

EBA data for 2019 show that Kenya continues to rank the highest, followed by Tanzania, Uganda, Rwanda and Burundi (Figure 5). Kenya ranks particularly high on securing water, registering machinery and trading food. The World Bank (2019) notes that digital reforms introduced in Kenya have contributed towards a reduction in time and costs of procedures. For instance, by issuing phytosanitary certificates electronically, Kenya’s Health Inspectorate has increased government revenues by 75% and saved exporters an estimated 72,000 km in travel annually (ibid.). Although overall Burundi lags behind other EAC countries on the EBA index, it is one of the most reformed countries since 2017. In addition to improving its phytosanitary measures, it has also improved access to financial services by enacting a comprehensive legal framework on agent banking and electronic money. Moreover, in the seed sector, the government has improved access to information on seed performance by introducing an official variety catalogue.

Figure 5: EAB index scores, EAC countries, 2019



Source: World Bank (2019)

Overall, this section notes that there are varied levels of development when it comes to digital readiness of countries in the EAC, with Kenya the most advanced, followed by Rwanda, Uganda, Tanzania, South Sudan and Burundi.

Box 1: D4Ag lessons from Kenya

D4Ag in Kenya has benefited from its high levels of connectivity, mobile phone usage and data transparency, as well as rise of Safaricom's M-Pesa and of mobile money over the past decade. Around half of venture capital/private equity investment in AgTech in Sub-Saharan Africa occurs in Kenya.

- Donors/non-governmental organisations (NGOs) tend to fill the gaps by supporting those solutions that do not focus on mobile money. For example, the agricultural supply chain, iProcure, is partnering with existing agricultural dealers in Kenya.
- Growth and expansion of platforms such as iKilimo and iCow has been hampered by the lack of strong partnerships among stakeholders and by weak evaluation and monitoring. Intermediaries can play an important role in encouraging partnerships. For example, AgriFin has become an early leader in this effort, hosting networking opportunities for entities active in agriculture finance.
- Policies around data privacy and customer protection are yet to be developed fully but Kenya has a Draft Data Protection Bill (2018).
- Bundled services for farmers are better positioned to capture revenue opportunities.
- Farmers are wary of fully digitalised D4Ag services; human intermediation (agent networks) in D4Ag continues to be important.

Source: Tsan et al. (2019)

2.2 Regulatory readiness for Ag-platforms

In terms of readiness on the legal and regulatory front, it is important to understand how developed the ICT regulatory frameworks for various countries in East Africa. This lends a direction to the possible level to which Ag-platforms can grow and proliferate within the national boundaries and across borders.

Table 1 compares progress on ICT regulations using the International Telecommunication Union (ITU) ICT Regulatory Tracker, which identifies trends in ICT legal and regulatory frameworks. While it does not measure the quality or the level of implementation or performance of regulatory frameworks, it helps progress and identify gaps in **national regulatory frameworks** using four dimensions: **regulatory authority, regulatory mandate, regulatory regime and competition framework** (ITU, 2018). The regulatory authority dimension includes indicators measuring, for example, the presence of a separate ICT regulator, autonomy of the regulator in decision-making, accountability, enforcement power, dispute resolution and the presence of a competition authority. Regulatory mandate examines who has control in the country for regulating the following: licensing, quality of service obligations measures, radio frequency allocation, universal accesses, broadcasting and internet content. In turn, regulatory regime captures the existence of regulations in major areas, including types of licensing, use of VoIP services, mandated infrastructure sharing and co-location, and presence of a national plan that involves broadband. Lastly, competition framework measures the level of competition in the main market segments within the ICT sector – that is, in local and long-distance fixed-line services; 3G, 4G and other services, as well as foreign ownership or participation in facilities-based operators; spectrum-based operators; local service operators/long-distance service operators; international service operators; and internet service providers (ISPs).

Using this ICT Regulatory Tracker, Table 1 compares East African countries with other selected countries across the four different dimensions. Within the EAC, Kenya ranks highest, followed by Uganda and Tanzania. Interestingly, Rwanda ranks at the bottom, lagging particularly on the competition framework aspect.

Table 1: ICT regulatory readiness

Name	Regulatory authority	Regulatory mandate	Regulatory regime	Competition framework	Rank
Ghana	18	21	22	27	42
Kenya	18	21.5	21	27	45
Uganda	17	20	22	27	52
Tanzania	20	21	19	25	62
Rwanda	20	20	18	24.33	73
Nigeria	17	20	20	21.33	91
South Africa	17	17	24	13.33	112

Source: ITU ICT Tracker

Table 2 compares EAC countries on the basis of ICT practices and regulations. Tanzania scores 7 out of 10 on ICT good practices, followed by Kenya (6), Burundi and Uganda (4) and Rwanda (3). All EAC countries except Burundi offer unbundled operating and spectrum licences for mobile operators, with more legally stated renewal criteria in Kenya and Tanzania. In both Uganda and Rwanda, the renewal criteria for licences (operating and spectrum) are not present in the law. Uganda and Tanzania allow both active and passive infrastructure sharing between mobile network operators (MNOs) legally, and mobile virtual network operators (MVNOs) are allowed to operate in the EAC except in Rwanda.

Table 2: ICT practices in the EAC, 2019

Economy	Burundi	Kenya	Rwanda	Tanzania	Uganda
Count of good ICT practices (0–10)	4	6	3	7	4
Unbundled operating and spectrum licences for MNOs	No	Yes	Yes	Yes	Yes
Presence of operating licence renewal criteria for MNOs in the law?					
a. Structure of renewal fees	No	Yes	No	Yes	No
b. Renewal period	No	No	No	Yes	No
Presence of spectrum licence renewal criteria for MNO in the law?					
a. Structure of renewal fees	N/A	Yes	No	Yes	No
b. Renewal period	N/A	Yes	No	No	No
Is voluntary spectrum trading among MNOs allowed by law?	No	No	No	No	No
Is passive infrastructure sharing between MNOs legally mandated in your country?	Yes	Yes	Yes	Yes	Yes
Is active infrastructure sharing between MNOs legally mandated in your country?	Yes	No	No	Yes	Yes

Economy	Burundi	Kenya	Rwanda	Tanzania	Uganda
Is national roaming between MNOs legally mandated in your country?	Yes	No	Yes	No	No
Are MVNOs allowed by law to operate in your country?	Yes	Yes	No	Yes	Yes
What type of operating licence is required for MNOs offering core mobile services (voice, SMS, data) in your country?	Individual	Individual	Individual	Individual	Individual
Is the licensing framework for MNOs offering core mobile services in your country both technology- and service-neutral, by law	No	Both	Tech-neutral	Both	Tech-neutral
What is the validity (in years) of an operating licence for MNOs offering core mobile services?	15	15	15	25	20
Are first-time and annual fees of an operating licence publicly available?	Both	Both	Annual	Both	Both
What is the lowest frequency spectrum (including digital dividend) in megahertz (MHz) ever licensed to mobile operators in your country?	800	800	800	700	900

Source: World Bank (2019), additional data

However, in e-commerce legislation, Rwanda is doing better than other EAC countries (Table 3). The country has an active legal framework across all four dimensions considered: electronic transactions, data protection, consumer protection and cyber-crime prevention. All countries have legislation on e-transactions. In Kenya, for instance, acts on electronic transactions include the Kenya Communications (Amendment) Act 2008 and the Information Communications (Electronic Transactions) Regulations 2016. Kenya, Rwanda and Uganda also have a legal framework for consumer protection online and on cyber-crime; Tanzania has draft legislation. EAC countries are lagging in terms of data protection/privacy: only Rwanda has active legislation.

Table 3: E-commerce regulatory readiness

	Electronic transactions/ e-signature	Data protection/ privacy online?	Consumer protection when purchasing online?	Cyber-crime prevention?
Kenya	Yes	Draft	Yes	Yes
Rwanda	Yes	Yes	Yes	Yes
Uganda	Yes	Draft	Yes	Yes
Tanzania	Yes	Draft	Draft	Draft

Source: UNCTAD e-commerce indicator

Each of these factors is critical to the development of Ag-platforms. For instance, data protection is key when collecting financial and personal data of farmers; electronic signatures are needed on agricultural contracts within the Ag-platforms (e.g. buyers–farmers/platform owners); there needs to be protection of

farmers as consumers when purchasing various services and products online through the app; and ensuring data are sent and collected over encrypted logics is necessary to maintain data security.

In sum, regulatory preparedness varies significantly across countries, especially in terms of conversion of draft laws into implementable acts/laws or protocols. Each of these aspects – ICT practices and authorities, mandates and competition frameworks – sets the landscape for supporting the development of Ag-platforms within each country.

2.3 Women and youth inclusion in Ag-platforms

It is critical to note whether there exist gendered digital divides that prevent women from accessing the services that will facilitate use of Ag-platforms. A large proportion of women in East African countries work in the agriculture sector: 96% of women in Burundi, 76% in Kenya, 84% in Rwanda, 71% in Tanzania and 77% in Uganda (UNCTAD, 2017). However, a significant literature suggests that women are still marginalised as a result of socio-cultural norms that curb their basic rights and entitlements (such as land ownership), given lack of access to the internet, basic skills and education (Commonwealth Secretariat, 2020). Only 17% of students pursuing degrees in science and technology subjects in Kenya are women, 24% in Tanzania and 18% in Uganda (WEF, 2018). Women are also less likely to access financial services, and particularly less via mobile technology (Hunt and Samman, 2016). Women are on average 14% less likely to own a mobile phone than men, which translates into 200 million fewer women than men owning mobile phones in low- and middle-income countries.

Another important aspect is the increase in youth participation within Ag-platformised value chains, as both developers and users of Ag-platforms. The EAC has a young population, with a large share of the labour force made up of 18–35 year olds. To boost youth inclusion in the future workforce, East African countries will need to design national strategies to develop young people’s digital skills and build an enabling environment for innovation, entrepreneurship and job creation in the digital economy.

Beyond increasing access to secondary and tertiary education as well as science, technology, engineering and maths (STEM)-focused technical and vocational education and training (TVET), this will require changes in the curricula, effective and quality provision of digital and soft skills training, continuous professional development of TVET trainers, investment in digital infrastructure and linkages with a dynamic private sector to align skills taught with industry needs (Banga and te Velde, 2018). For out-of-school youth, marginalised sections of society and adult learners, access to digital and soft skills training can be expanded through non-formal TVET.

An excellent example of non-formal TVET delivering future-relevant skills is the Digital Ambassadors Programme (DAP) in Rwanda, a joint initiative by the World Economic Forum (WEF) Internet for All, the Digital Opportunity Trust and Rwanda’s Ministry of Youth and ICT. This is mounting a three-pronged push to boost internet access, skills training and jobs in Rwanda. DAP aims to employ 5,000 young Rwandans, with 50% participation of young women and girls, as digital skills trainers. These Young Digital Ambassadors will receive training in essential digital skills and soft skills, which they will then draw on to provide hands-on training across the country (WEF 2017).

3. MODELS OF AG-PLATFORMS IN UGANDA AND RWANDA

This section illustrates five types of Ag-platform delivery business models across a value chain, which consist of a combination of various scopes (breadth of functions and processes) and scales (ultimate destination of final product). It is important to note that each Ag-platform model's uptake is linked to the 3Cs and can vary depending on each country context.

3.1 Scope and scale of Ag-platforms

Scope refers to the breadth of services that substitute for or complement the traditional functions and processes in an agricultural value chain. Box 2 briefly presents the nine types of scope. For further details on scope, our 'Platforms in Agricultural Value Chains: Emergence of New Business models'.

Box 2: Types of scope

Backward exchange refers to the input services (e.g. chemicals, seeds) platforms offer to farmers. Platform firms connect farmers to input suppliers in several ways, either directly linking them to validated input suppliers, who offer quality products often at subsidised prices, or aggregating several input suppliers and providing subsidised 'packages' of inputs .

Forward exchange refers to a platform's creation of an online output marketplace such as an auction structure, where bids are virtual. Prices are expected to follow current spot market (and futures market if the country has a commodity derivative market) prices and bids are transparent.

Marketplace matching: The platform firm reaches out to various buyers and connects farmers to the aggregated buyers, who can be wholesalers, processors or retailers. This involves significant dis-intermediation.

Information services involve complementary services include information on microclimates (weather), real-time market prices, yield, high-quality agricultural extension, such as pest and disease mitigation and prevention, and good agricultural practices that are key to enhancing farmer capability.

Complex information services comprise big data decision support through AI, land contour mapping (GPS) and management information, such as enterprise resource management (ERP)¹ to organise farm activities through the use of sensors. These are complex, as they require the capabilities to use smartphones and comprehend sophisticated information.

Production and harvest services cover leasing tractors and other machinery, weeding and spraying, picking and cleaning short-term labour hiring, and subsidised prices for soil and water. These occur upstream in the value chain.

Horizontal offers include finance for inputs and commercial expansion through loans or working capital. It also includes insurance for crops and climate extremes, and climate and ICT training.

Guaranteed purchase and prices is when platform firms act as 'buyers' and proceed to guarantee purchase of the commodity and a contracted price.

Sharing and exchange of knowledge includes chat platforms and free/subsidised calls to other farmers participating on the same platform.

Scale, in a value chain context, is the 'global', 'regional' and 'local' dimension. This refers to the territories and the networks that are covered from the stage of production to the sale of the product (Coe and Hess, 2013; Ponte and Sturgeon, 2014).

¹ ERP is business process management software that allows an organisation to use a system of integrated applications to manage the business and automate many back-office functions related to technology, services and human resources.

- A 'global' value chain is a southern supplier selling final or intermediary products to northern end markets.
- A 'south–south' value chain is a southern supplier selling final and intermediary products to southern end markets.
- A 'regional' value chain involves suppliers selling final and intermediary products in regional blocs or one-world regions, such as EAC, SADC or the EU.
- A 'domestic' value chain occurs when local suppliers sell products within the national territory of a country, to both formal and informal markets.

Ag-platform characteristics of scope node and scale described in the section above are integrated into five models, which most commonly occur on the ground. These models are 'modular' in nature, in the sense that they are created by combining different types of scope and scale together. Needless to say, several permutations and combinations of the scope and scale may exist; however, the five identified in this study are the most recurring Ag-transaction platforms that are prevalent within Africa.

Table 4: Summary of models of Ag-platforms

Model	Type of scope				Node	Scale (by order of occurrence)
	Backward exchange	Horizontal offers	Information services + complex services	Production and harvest services		
Production exchange	Backward exchange	Horizontal offers	Information services + complex services	Production and harvest services	Upstream (pre-production, production, post-production)	Local, S–S, regional
Output exchange	Forward exchange	Horizontal offers	Information services		Downstream, Midstream	Local
Trading and sharing	Marketplace matching	Horizontal offers	Information services, production and harvest services, complex information services	Sharing and exchange of knowledge	Upstream, Midstream and Downstream	Global, local, S–S, regional
Guarantee purchase and logistics	Guaranteed purchase and prices	Information services			Midstream and Downstream	Local, regional
Single buyer-integrated	All				Upstream, Midstream and Downstream	Global, S–S, regional

Source: Authors' construction

The *production and exchange model* consists of three scopes: backward exchange, horizontal offers and information services, generally at the pre-production and production stage of the value chain.

Output exchange consists of three scopes: forward exchange, post-harvest and information services. This is an auction-based model, wherein farmers are provided information on crop prices and on logistic prices to transport products, as well as post-harvest services such as grading and packaging. This occurs primarily midstream or downstream in the value chain depending on whether the product is final or intermediate.

Trading and sharing consists of five scopes: marketplace matching, horizontal offers, information services, complex information services, production and harvest services, and sharing and knowledge exchange. This model covers the full value chain, as it includes services from the pre-production stage to the output sale. Ag-platform firms make deals with a range of actors on a commission basis, from input suppliers, to banks and insurance providers, weather data providers, universities and transport providers. This is expected to reduce bottlenecks considerably for farmers and increase transparency with regard to the prices of services.

Guarantee purchase and logistics consists of two scopes: guaranteed purchase and prices, and information services. In this case, Ag-platform firms act as intermediaries and buyers, by taking the onus of loss onto themselves. They provide farmers with contracts, along with a guarantee of purchase at specific market defined prices. They also act as farmers' guarantors in case farmers require working capital loans for the purposes of production. Simultaneously, Ag-platform firms seek to make deals with processors, and retailers across local, regional, southern and northern end markets to whom they further sell the produce.

The *single buyer-integrated* model works within a completely vertically integrated value chain, wherein the main off-taker, be it a processor or a retailer, directly controls the entire value chain and there is already a predetermined market (i.e. prior contract with final buyers already exists).

The models of Ag-platforms do not exist in a vacuum: the 3Cs of Cost, Complexity and Capabilities, along with digital and regulatory readiness (enabling environment), are important factors driving their adoption and proliferation. In terms of costs, interviews with farmers and Ag-platform firms suggested that, in general, the trading and sharing model is the most expensive, as costs mount up in relation to in-app services, costs of maintaining the Ag-platform, data plans and premiums paid for insurance/credit products, while the costs for output exchange models are generally low, as logistic costs are borne by the farmers, and the main costs relate to SMS/voice message costs for matching services. The costs for guaranteed purchase and logistics vary between high and medium depending on the level of risk an Ag-platform is willing to take to guarantee the products for the farmers. The production exchange model as well as the single buyer model vary between medium and low depending on the amount of subsidy that farmers receive from the donors, the costs to maintain the app (developers, marketing) and the deals/commissions that input suppliers and buyers on the platform are willing to shell out to the platform to participate.

Table 5: The 3Cs and Ag-platform models

Model	Cost of product	Complexity of product	Capabilities of users
Production exchange	Medium/low	High/medium	High
Output exchange	Low	Medium/low	Medium
Trading and sharing	High	High/medium	High
Guarantee purchase and logistics	High/medium	High/medium	Medium/low
Single buyer-integrated	Medium/low	High/medium	Medium/low

Source: Authors' construction (data collected from interviews)

In terms of complexity of use, most of the apps and AI-related functions were seen as the most complicated; thus, variants of production exchange, trading and sharing, guarantee purchase, and logistics and single buyer were all seen as relatively complex. Directly related to the complexity of the product are the capabilities of users – that is, farmers – in terms of the ICT skills required along with soft/management skills to run a farm. According to interviews, trading and sharing and production exchange require the most

knowledge, given the large number of in-app services available, whereas single buyer and guaranteed purchase require fewer capabilities as there is significant support from extension officers. However, without this support, these apps would be almost impossible to run. In the next section, we attempt to provide examples with regard to each of these from case studies in Uganda and Rwanda.

3.2 Ag-platform models in Uganda

We interviewed a total of 825 farmers by survey, as well as 6 government officials, 14 Ag-platforms, 5 cooperatives, 4 buyers, 3 brokers, 6 donors, 5 input suppliers, 3 co-working space managers and 1 mobile operator, to gauge a landscape of the types of models prevalent in Uganda (see Appendix A), as well as the key opportunities and challenges facing Ag-platform firms, farmers and women.

The proliferation of Ag-platforms in Uganda has been home-grown, with several local entrepreneurs developing and running successful Ag-platforms. The Ag-platform firms were selected through snowball sampling and cross-validated using lists procured from sub-national government officers and area officers. See report on 'Platforms in Agricultural Value Chains: Emergence of New Business Models' for details on each of the apps. 50% of the apps are production and exchange-related, followed by 20% trading and sharing and one each for output exchange and single buyer-led. None of the apps (or others known to government/other app developers) provide guaranteed logistics and purchase. Table 6 provides a short summary of the apps, with key information on ownership, farmers registered, types of crops and partners involved.

Table 6: Ag-platform model app examples in Uganda

Name of app	E-Voucher	Viral Cassava	M-Omulimisa	Kudu	EzyAgric	KOPGT
Model of Ag-platform	Production and exchange	Production and exchange*	Production and exchange	Output exchange	Trading and sharing	Single buyer-led
Ownership of app	Ugandan: government	Ugandan/ German: Makerere	Ugandan: MSE	Ugandan: MSE	Ugandan: MSE	Bidco: Kenyan MNC
First year of operation	2017	2017	2017	2015	2014	2014
No. of farmers registered	880,000 (expected 450,000)	1,000	13,314	3,067	60,000	1,810
Females (%) registered	30	30	35		40	37
Active users (% of registered)	54	21	45	65	55	60**
Amount spent on app (per month)	Ush 1,000	Ush 0 (subsidised)	Ush 1,200	Ush 0 (subsidised)	Ush 1,600– 2,800	Ush 400
Key crops	Coffee, rice, beans, cassava, maize	Cassava	Maize, soybean, sunflower, sorghum	Maize, beans, sorghum, rice, soya	Cereals, cassava, bean	Palm oil

Name of app	E-Voucher	Viral Cassava	M-Omulimisa	Kudu	EzyAgric	KOPGT
No. of districts served	5 (expected 42)		51	20	40	4
Key partners and funders	NARO, NAADS, Ministry of ICT, Ministry of Science, Technology and Innovation, World Bank	Makerere University, Pulse Lab Uganda, University of Groningen and University of Cambridge, Bill & Melinda Gates foundation	Vision Fund, Opportunity Bank, USAID, Michigan State University	AI and Data Science Makerere, University of British Columbia, University of Chicago, Microsoft Research	USAID: Next Billion, WFP, ICT Works, Seep	SAP, IFAD, MAAIF, GLTN

Notes: * This includes complex AI services.

** Issues of land grabbing in the area have surfaced (<https://www.theguardian.com/global-development/2015/mar/03/ugandan-farmers-take-on-palm-oil-giants-over-land-grab-claims>)

Source: Fieldwork interviews 2019, <https://m-omulimisa.com/>

The results suggest that most Ag-platforms work through farmer groups or cooperatives and frequently hire youth champions, who act as agents. At the outset, there seems to be a clear issue with the uptake of Ag-platforms; in general, except in one case, less than 60% of farmers used the services offered to them. This could possibly be because of a significant focus on production and exchange models, rather than models that focus more downstream or midstream, like trading and sharing. The lack of marketplace matching and guarantees seem to have reduced overall trust in the system.

In terms of the 3Cs, overall, the results suggest that adoption rates have increased most in production and exchange models (M-Omulimisa and E-Voucher), because of relatively low costs and the limited nature of the complexity and capabilities required. Much of the change in trading and sharing models (EzyAgric) significant due to support from donors, hands-on approach of the Ag-platform staff and significant growth of the app in urban and peri-urban farming, led to the high rate of adoption despite the higher costs and capabilities associated. Finally, for the single buyer-led model (KPOGT), the process of qualification was more cumbersome, as it specifically targeted palm oil growers living with specific spatial boundaries, thus it a much more captive form of value chain, with all the production going into a single lead firm (Bidco's) processing plant.

In relation to value capture opportunities, trading and sharing platforms have shown the most improvement in terms of productivity, value addition/diversification, number of jobs created and gender inclusion, followed by production and exchange, single buyer-led and output exchange. Productivity appears to have increased for almost all Ag-platform models, in terms of increase in crop yields as well as improvements in farm management practices and labour productivity. Value addition/diversification appears to have improved across trading and sharing and production and exchange Ag-platform models, where farmers have been seen to upgrade by diversifying to new products.

Table 7: Ag-platform models and value creation opportunities in Uganda

Model of Ag-platform	Name of Ag-platform	Productivity	Value addition/diversification	Number of jobs	Formalisation of jobs	Gender inclusion
Production exchange	E-Voucher	Marginal increase in crop yield and more efficient use of natural resources	No change	No change	Increased formalisation: more written contracts provided and bank accounts opened (better access to credit)	No change
Production exchange (with AI)	Viral Cassava android app	Increase in crop yields owing to early detection of pests	No change	No change	No change	Increase
Production exchange	M-Omulimisa	Increase in yields and	Increase, new products	Marginal Increase	Increase	Marginal increase
Output exchange	Kudu	No change	Increase, new products	No change	No change	No change
Trading and sharing	EzyAgric	Increase	Increase, to new products	Increase	Increase, in those registered on government rosters, new bank accounts and credit facilities	Marginal increase
Single buyer-integrated	KOPGT	Increase	No change	Marginal increase	Marginal increase	No change

Source: Authors' construction from interview data

An important feature is the low number of jobs created, in all cases but EzyAgric (trading and sharing model). This latter Ag-platform has been able to tap into a new customer base of urban and peri-urban professionals who also farm as a side-business. There is also a clear trend of low female participation/gender inclusion in Ag-platforms, through lack of mobile phones (e.g. the male member in the family owns and uses the mobile phone).

3.3 Ag-platform models in Rwanda

A total of 12 interviews were conducted among 15 participants in country, with two follow-up interviews over telephone. Interviews were semi-structured and based on a survey of 10 essential questions. Despite a background list of almost 30 different apps in Rwanda, the non-response rate was very high. Many of these initiatives – including applications such as AgriGo, ehaho, YEAN, Zirakamwa, MCC, Arduino and Inyungu – have not been sustainable and have effectively suspended operations for the time being owing to lack of funding, capacity and a sustainable business model. The only applications that remain in operation are donor- or government-funded. Almost all of these remaining apps are categorised either as production and exchange or as trading and sharing. Unlike Uganda, which is dominated primarily by donors, Rwanda has many more government-supported apps and projects, run by the Ministry of Agriculture (MINAGRI) and the Ministry of Commerce (MINICOM). We identify six apps in Rwanda that have been gaining importance over the past two years (Table 8).

Table 8: Ag-platform model app examples in Rwanda

Name of app/project	SPARK IPoVaF	Heifer International	TechnoServe SMS Bookkeeping Credit Monitoring System	MINAGRI MIS	1AF	SWC (formerly SFR)
Model of Ag-platform	Trading and sharing	Trading and sharing	Production and exchange	Trading and sharing	Production and exchange	Production and exchange
Ownership of app	Dutch NGO	US NGO	US NGO	Rwandan government	US NGO	Rwandan
First year of operation	2017	2017	2012	2016	2013	2014
No. farmers registered	7,000	17,000	32,923 (2015)	600	No information	8,000
Females (%) registered	Forthcoming	Forthcoming	42% (2015)	No information	No information	No information
Active users (% of registered)	Forthcoming	Forthcoming	Forthcoming	No information	No information	No information
Amount spent on app (per month)	Rwf 0	Rwf 0	Rwf 0	Rwf 0	Rwf 0	Rwf 10/SMS
Key crops	Irish Potato	Dairy	Coffee	Cassava, dairy, Irish potato, maize, rice	Inputs (all commodities)	Weather information (Irish potato)
No. of districts served	4 (Burera, Musanze, Nyabihu, Rubavu)			Country-wide	Country-wide	Northern province (Musanze)

Name of app/project	SPARK IPoVaF	Heifer International	TechnoServe SMS Bookkeeping Credit Monitoring System	MINAGRI MIS	1AF	SWC (formerly SFR)
Key partners and funders	AFR, Rwandan government, USAID, UKAid, Mastercard Foundation, Sida, Netherlands government	AFR, Rwandan government, USAID, UKAid, Mastercard Foundation, Sida	AFR, Rwandan government, USAID, UKAid, Mastercard Foundation, Sida, TechnoServe	Government	Independent	Independent

Source: Authors' construction from interview data

Most platforms are essentially SMS or USSD-based knowledge-exchange systems that work either way, by providing farmers with information on weather, prices or know-how or by providing app developers with information on farm-level transactions (in order to provide advance payments). The only initiative that has faced higher costs, complexities and capabilities is the Heifer International project, which involves smartphones. Given the nature of Rwanda's agriculture sector, which is heavily smallholder-based, and the deep poverty that persists in rural areas, the gap effort required to improve capacity among some farmers in order to use such technology is substantial (as the project staff themselves have acknowledged).

Table 9 presents some preliminary results based on interviews, as well as some information from the predecessor of TechnoServe's Coffee Digitalisation project. The impact of Rwanda's Ag-platforms has mainly taken the form of productivity increases. These have been achieved through knowledge-sharing and/or the provision of upfront finance. In the case of Heifer, providing credit at times when dairy farmers need to provide their cattle with good-quality feed has had enormous impacts on raw milk yields. Yield increases have also been reported for the IPoVaF and Coffee Digitalisation projects. SWC reported a significant reduction of fertiliser use, as farmers were able to more reliably predict weather associated with decreased fertiliser efficiency. The impact of Ag-platforms on jobs (both number and formalisation) as well as gender inclusion has been very limited in Rwanda.

In sum, it is difficult to indicate the net effect of the increase and no change scenarios, as it is possible that the increase in some value creation pathways – for example productivity – could outweigh the effects of diversification. The next section delves deeper into policy gaps that exist in Uganda and Rwanda that hamper the functioning of Ag-platforms; and also looks at how Ag-platforms can act as a 'bridge' to plug deficits in policy. It thus shows that Ag-platforms can reduce policy failures but at the same time require policy support in order to grow.

Table 9: Ag-platform models and value creation opportunities in Rwanda

Model of Ag-platforms	Name of Ag-platform	Productivity	Value addition	Number of jobs	Formalisation of jobs	Gender inclusion
Trading and sharing	IPoVaF	Improved yields owing to credit uptake and information-sharing on best practice planting/harvesting techniques	Identifying markets for individual farmers, including volumes required and prices offered, that farmers can bid on	No change	No change	Women, with young people, particularly interested in new technology
Production and exchange	Heifer International	Increase in production linked to availability of feed at times of need owing to presence of finance	Improved living conditions, adoption of communal healthcare insurance (5/20 cooperatives)	Diversification has led to new jobs in feed and milk processing capacity (e.g. cheese, yoghurt, etc.)	These new jobs have been formalised	No change
Trading and sharing	SMS Bookkeeping Credit Monitoring System	62% coffee income increase (2015)	Raised \$4,631,668 of working capital for cooperatives, as well as \$203,580 of capex (2015)	No change	No change	38% of trained farmers were female (2015)
Trading and sharing	MINAGRI MIS	No change	Improved efficiency within government	No change	No change	No change
Production and exchange	1AF	On average, yield increases for farmers are 40–50%	Improves business processes – cheaper and less administrative for 1AF. Also reduces fraud. For farmer, commercialisation can lead to life away from subsistence farming	No change	No change	No change
Production and exchange	SWC	No change	Improved application of fertilisers for potato	No change	No change	No change



Source: Authors' construction from interview data

4. AG-PLATFORMS AS A WAY TO PLUG NATIONAL POLICY GAPS

Ag-platforms can 'fill policy gaps' by acting as temporary stop-gaps before further investment is made to create better solutions. For instance, through the provisioning of working capital loans and insurance facilities, production and exchange models as well as trading and sharing models can support farmers to gain access to credit, which they otherwise would not have received as a result of the regulatory challenges of microfinance and the high costs of borrowing (Krishnan et al., 2020).

The key is to identify where the gaps are, what Ag-platforms can do to fill these and what they need to continue to proliferate so they can offer long-term solutions to farmers and workers. Increasingly, platforms are altering governance structures within agriculture, changing the architecture of business-as-usual conditions through new forms of matching, networking and diffusion of innovations (Adekunle and Fatunbi, 2012), as shown in the varied models described in the section above. This section highlights a range of 'policy gaps' that may exist, hindering the proliferation of platforms and weakening the overall ecosystem for digitalisation. Seven key policy gaps are identified:

1. Finance and institutional gaps: These can include inefficient allocation of public budgets, inadequate financial structures such as credit instruments, mobile money infrastructure and warehousing receipt systems.
2. Infrastructure gaps: These include high-cost public goods such as transport infrastructure (roads, railways), warehousing systems, agricultural equipment and machinery (e.g. irrigation), weather stations and power (grids, especially renewables like hydro and solar), along with digital infrastructure such as broadband ICT networks and data servers.
3. Regulatory gaps: These include lack of downstream value addition industrial policy support, lack of comprehensive e-commerce frameworks, lack of technology transfer and poor intellectual property regimes (e.g. sharing of source codes).
4. Land governance, gender and youth participation gaps: These are prominently bottom-up enablers that focus on empowering youth, women and farmers in order to securely uptake Ag-platforms. The issues range from land ownership and titles, to gender-equitable opportunities to access new technology and equal remuneration and supporting youth entrepreneurship programmes and leadership training.
5. Gaps in cooperation and partnerships for the facilitation and implementation of policies: These include provisioning for the private sector (especially lead firms) and comprehending a mix of effective partnerships across stakeholders to prevent concentration of power in the hands of some actors. For instance, this could involve increasing last-mile delivery of partnerships like the Comprehensive Africa Agriculture Development Programme (CAADP), which brings together African agricultural research institutions, farmers' associations, African governments and the private sector. These gaps extend to improving coordination activities across ministries in the government as well as across stakeholders in partnerships, and finally harmonisation of regional policies for trade facilitation
6. Gaps in resilience of livelihoods: These relate to creating oversight, monitoring, transparency and accountability structures to increase trust (social capital) between value chain actors.
7. Gaps in skill provisioning: This involves improving capabilities of lower-tier actors such as farmers through the provisioning of ICT and soft skills (e.g. basic to intermediate job-neutral digital skills, job-specific digital skills and soft skills)

Table 10 highlights key existing policy gaps, and provides indicators that need to be modified in order to ensure effectual functioning of the policy. The next section explores each of these issues through the case studies of Uganda and Rwanda.

Table 10: Policy gaps and value creation/ capture

Policy gaps	Indicators of governance deficits	Key issues
Finance and institutional gaps	Misallocation of public spending of agricultural support	Inefficient subsidies expenditure; limited research and development in relation to agriculture; lack of product licensing and validation facilities (quality of chemicals)
	Financial challenges: credit, mobile money, micro insurance	High cost of borrowing and limited investment in small farms; absence of formal banking; cost of mobile money transfers, warehouse receipt systems; micro insurance
Infrastructural gaps	Physical infrastructure: manufacturing capabilities, digital barriers (e.g. mobile services; data/digital infrastructure)	Transport infrastructure (roads, railways) warehousing systems, agricultural equipment and machinery (e.g. irrigation); power (grids, especially renewables like hydro and solar) communication and digital infrastructure (e.g. Broadband ICT Network, data servers)
Regulatory gaps	Lack of investment in downstream value addition (downstream industrial policy)	Marketing and branding; packaging; processing at source; quality enhancements
	Lack of comprehensive e-commerce framework	Cyber-security and cyber-crime laws; payment systems laws; Electronic transactions; data localisation
	Poor framework for intellectual property (digital and agricultural)	Implementation of TRIPs (digital and biopiracy); copyright and digital content piracy
Land governance, gender and youth participation gaps	Growing land tenure issues and disputes; formation of cooperatives	Land ownership rights and deeds; digitising land titles (GPS enabled); transparent dispute settlement systems; precarious contracts for farmers; lack of ability to unionise (producer/ trade unions)-
	Lack of gender equality	Women's empowerment and rights/entitlements
	Lack of support for youth entrepreneurship and growth of micro and small enterprises (MSEs)	Supporting young micro and small enterprises in the ag-digital space over incumbents; tax breaks and funded/subsidised accelerator programmes

Policy gaps	Indicators of governance deficits	Key issues
Gaps in cooperation and partnerships for facilitation and implementation of policies	Undermining private sector	Creating effectual partnerships with power balance to prevent clientelism ²
	Regional trade facilitation: lack of harmonisation	Support of tech transfer; mobility of trained individuals; harmonisation of tariffs and non-tariffs barriers; implementation of CAADP
	Lack of coordination across ministries and other value chain stakeholders	New risk-sharing structures to improve overall coordination efforts
Gaps in resilience of livelihoods	Lack of monitoring and accountability: trust	Licensing of traders and validation of products cross border; technological development to monitor progress and ability for farmer to self-assess and share feedback; trust-building exercises through frequent networking and experience exchange opportunities
	Limited funds and technical expertise for skill development	Basic to intermediate job-neutral digital skills such as accessing the internet, digital advertising and data analysis; job-specific digital skills such as computer programming and web-app development; soft skills such as communication, management and critical thinking.

² Clientelism is the exchange of goods and services for political support, often involving an implicit or explicit *quid pro quo*. Clientelism involves an asymmetric relationship between groups of political actors described as patrons, brokers and clients (Kitschelt and Wilkinson, 2007).

4.1 Ag-platforms as a way to plug national policy gaps in Uganda

Each of the aforementioned platforms faces several challenges that prevent proliferation and efficient functioning. Summary Table 10 presents each of the policy gaps that affect the different models of Ag-platforms.

4.1.1 Finance and institutional policy gaps

Misallocation of public spending of agricultural support: Approximately half of the total agricultural budget between 2017 and 2023 is expected to be devoted to purchasing and disseminating subsidised inputs (Republic of Uganda, 2017), rather than investing in public goods such as training, better roads and communications infrastructure, or improving the quality of inputs and input distribution systems themselves. The two government-funded apps of the National Agricultural Research Organisation (NARO) and E-Voucher are also to a large extent based on a subsidised model, offering farmers seeds and inputs, but is an improvement as it also offers information services and is creating a dataset to profile farmers and vet agro-vets.

Ag-platform models as bridging the gap: The use of trading and sharing, output exchange and production and exchange models provides a host of additional services, such as matching suppliers and buyers and horizontal services, etc., which invest in other nodes of the value chain. These models are driven by private governance through MSEs, international organisations through multi-stakeholder partnerships, rather than by the government.

Credit and mobile money: Finance is critical for smallholders to invest in better farming equipment and practices. Yet financial inclusion of smallholders has remained limited. The World Bank (2018) lists key challenges for financial institutions with regard to serving Uganda's agriculture sector: lack of usable collateral; high transaction costs owing to the remoteness of a dispersed set of clients; small size of farms and of individual transactions; weak communication and transportation infrastructure; high covariant risks as a result of variable rainfalls and price risks; and the physical absence of banking facilities in rural areas. Developing efficient mobile money transfers and warehouse receipt systems can potentially overcome such issues. Savings and Credit Cooperatives (SACCOs) registered in Uganda currently have weak legislation with minimal support from legal banking frameworks and no stringent monitoring or oversight mechanisms.

Mobile money is a key driver of e-commerce growth and financial inclusion. In 2018, the total value of transactions over mobile money platforms accounted for more than half of Uganda's GDP (UNCTAD, 2018). Mobile money platforms have evolved from providing peer-to-peer remittances and airtime top-ups to enabling access to more complex financial products, including savings, credit, insurance and person-to-government transactions. The main e-commerce payment solutions are cash on delivery and mobile payments. USSD is the most common technology in mobile financial services, and large MNOs are providing services for mobile payment as well as national financial inclusion (NFIs) through e-wallets, using a growing agent banking network.

Currently, Uganda's mobile money sector falls under the purview of the Uganda Communications Commission (which is not mandated to regulate financial transactions) and thus is effectively unregulated (EXPORT.GOV, 2019). The lack of regulations on the use and security of USSD transactions is increasing risks for end-users. Potentially unfair competition in the mobile money market also appears to be favouring the leading MNOs. The agent banking network provides important services, including cash withdrawals and cash deposit, to rural populations that are largely excluded from the formal banking sector. The Excise Duty (Amendment) Act, which imposes a 0.5% levy on withdrawals through mobile money platforms, is affecting consumer behaviour (UNCTAD, 2018).

In 2013, only 10% of total borrowers in the consumer lending market borrowed for agricultural production yet the majority of Uganda's population derive their sustenance from agriculture. However, with last-mile digitisation initiatives focusing from the onset on payments, mobile money providers have become key enablers and require direct or indirect partners in the implementation. GSMA (2017) identifies two

ownership models for last-mile digital payments in Uganda: a third-party/tech provider-led model (a so-called 'aggregator'), whereby the tech provider integrates with the mobile money service of one or more MNOs and offers its own bulk payments solution to agribusinesses; and an alternative mobile money provider-led model, whereby the mobile money provider offers a payment solution for last-mile sourcing directly to the agribusiness.

The case of Uganda shows that the agribusinesses that are more likely to adopt basic mobile money bulk payments are those with low ICT adoption; agribusinesses that are already using ICT tools are more likely to adopt holistic last-mile solutions that extend beyond payments. Generally, the experience of Uganda shows that the need to implement digitisation initiatives in the last mile is stronger in competitive value chains, where agribusinesses compete to procure crops from the same farmer. It is in these value chains that there is a strong incentive for the agribusiness to increase farmer loyalty (having farmers returning to sell their crop) and that digital tools can support farmer loyalty schemes (GSMA, 2017).

Basic mobile services such as SMS, USSD and automated voice deliver market and weather information to farmers, while mobile-based enterprise solutions rely on mobile money and cellular IoT to help agribusinesses digitise the procurement of crops from smallholder farmers and implement digital farmer records to support tractability and certification requirements.

Beyond structured agriculture solutions, farmers and different players in the agriculture ecosystem use mobile-enabled services, such as WhatsApp and other social media platforms, to share information and provide support to one another. In 2018, the government enacted a 0.5% tax on mobile money cash withdrawals and a \$0.05 daily tax on social media usage, leading to a decline of 50% in mobile money transactions (UNCTAD, 2018). Currently, the National Payments Bill is being debated in the Parliament. The Bank of Uganda will regulate e-commerce and mobile money transactions. The Bill proposes to give the Bank broad oversight authority, including the power to block e-commerce and mobile money transactions when it deems necessary (Export.Gov, 2019).

Ag-platform models as bridging the gaps: Production and exchange, trading and sharing and guarantee purchase and logistics models offer horizontal services through deals with banks, SACCOs, microfinance institutions and crop/climate insurance firms. Overall, data from interviews suggest the cost of borrowing is less than 13%, with Ag-platforms often acting as a guarantor to improve farmers' credit rating. Furthermore, the prevalence of mobile money and wallets helps farmers with financial management.

4.1.2 Infrastructure gaps

Road, rail, inland water transport network and power: About 140,000 km of Uganda is covered by these main forms of transport, which is less than 30% of the total country (Uganda Road Fund, 2014). Some progress has been made on the trade logistics side, particularly in the case of last-mile delivery in the national postal service network. Uganda Post Limited has increased its delivery fleet and services for home delivery service, and the government is in the process of providing each household with a formal postal code. Despite these improvements to the national postal service, express couriers or third parties are still delivering a large portion of goods-based e-commerce. Taxi services such as Uber Uganda, Friendship Taxi, SafeBoda and Quick Taxi already provide some transport logistics for e-commerce, and private couriers such as DHL Express, Yellow Pages Express and CourierMate Uganda also form an important part of the delivery logistics market. Bottlenecks remain in implementing the Trade Facilitation Agreement articles on expedited shipments and electronic payments. The absence of insurance companies providing services in this area increases the risk of e-commerce transactions.

Hydropower is the main source of power generation. Major hydropower stations include those at Kiira, which has an installed capacity of 200 MW, and Bujagali (250 MW capacity). Other major power sources include the Namanve thermal power plants (50 MW capacity). Electricity supply shortage is a major problem in Uganda, and 81% of its citizens do not have access to electricity (Enriquez et al., 2018). Power outages and lower connectivity are most commonly found in rural areas of Uganda, especially for those farmers who participate in domestic value chains, selling primarily to the local market (Gollin and Rogerson, 2010). These make up almost 80% of all Ag-platform participants in Uganda (interviews).

Data collection and servers: While the government of Uganda has yet to begin embarking on high-tech data-intensive soil collection, Ag-platforms also support the collection and storage of high-quality data. For instance, the Gates Foundation has already invested extensively over the past decade in building out the digital infrastructure for soil data collection, analysis and dissemination systems under the umbrella of its Africa Soil Information Service programme (now Innovative Solutions for Decision Agriculture – ISDA).³ The Gates Foundation is working on Agronomy-to-Scale data platform concept, which would build on ISDA’s soil data assets but develop much broader Africa-focused geospatial agronomy data sets and tools (e.g. crop maps) (Tsan et al , 2019).

Ag-platform model as bridging the gaps: Ag-platform models, such as guaranteed purchase and logistics and trading and sharing, act as ‘quasi infrastructures’, with the farmers able to access transport infrastructure through the platform. For instance, many platforms offer cheap logistics options and fair prices, as well as having aggregator collection points where produce can be deposited (acting as a warehouse). This enables farmers both to access transport networks and to have a safe space to store produce, which many reported not being able to do without the app. In the past, several farmers have alluded to selling at a 10% loss to brokers and middlemen (interviews).

Manufacturing capabilities for agriculture: For irrigation equipment and sprayers, etc. Uganda has been dependent on imports, rather than the development of own manufacturing capabilities. Recently, Ugandan government initiatives have been set up, such as the National Irrigation Policy, promulgated at the end of 2017. This is a start, but these are wrought with implementation issues. Factors such as corruption, lack of coordination among ministries and low levels of incentives for firms prevent the growth of the initiatives.

Another important quality issue relates to the increasing prevalence of adulteration of Ag-chemicals and the sale of fake seeds, which cause significant damage to soil quality and yields, affecting the economic status of farmers. While laws exist, such as the Adulteration of Produce Act 2000 (2019) and the Food and Drug Act 2005, these are not effectively enforced, leading to significant issues with productivity and natural resource management.

Ag-platform model as bridging the gaps: Production and exchange, trading and sharing, guaranteed purchase and logistics and single buyer-led Ag-platform models, through in-app purchases, are able to get support directly through platform vendors, who sell high-quality and validated inputs to them. Platforms provide support and leasing facilities to farmers for mechanisation on farms as well as training on how to use them. Furthermore, Ag-platforms act as intermediaries to gauge the quality of inputs supplied. Thus, Ag-platforms are able to support farmers at lower costs with mechanisation support even if the government cannot.

Digital hardware (infrastructure): The country had made significant efforts to become digitally ready. The National ICT Policy 2014 builds on key policy plans such as the National ICT Policy Framework 2003, the E-Government Framework Policy 2010 (draft) and the Telecom Policy 2011 (draft), with the aim of increasing access to and use of digital services in Uganda, to transform the country into a knowledge society by 2025. The National ICT Policy is also a key enabler for the Digital Uganda campaign, launched in July 2017 to foster innovation and create a positive socio-economic impact by empowering people through ICT-based services.

The Uganda Communication Commission and the National Information Technology Authority regulate the ICT sector under the oversight of the Ministry of ICT and National Guidance. Expanding access to and affordability of mobile services has been key to increasing internet penetration in Uganda – a land-locked country. About 70% of the population has access to a mobile phone. At a basic level, mobile technology provides connectivity to basic communications services and the internet. GSMA (2019) estimates that, in Uganda, just over 19.8 million people have a mobile subscription, representing 44% of the population. 2G

³ <http://africasoils.net/services/data/digital-soil-mapping/>

networks cover nearly the entire population, while mobile broadband networks (3G) cover 78% and 4G covers roughly 23% (GSMA). Overall, smartphone adoption is 60% in Uganda compared with 30% in sub-Saharan Africa. In terms of affordability, the selling prices of smartphones have declined by around 50% in Uganda since 2012 to less than \$100, owing to the influx of low-cost handsets from Chinese manufacturers, such as Tecno and Gionee (ibid.). Deployment of the National Backbone Infrastructure (NBI) has led to a reduction in internet bandwidth prices, with the average market price for 1 mbps reducing from \$632 in 2011 to \$267 in 2017 (UNCTAD, 2018).

Although the government has directed efforts towards increasing access to and affordability of mobile technology, more action is needed to increase mobile and internet penetration across the overall population. Despite the influx of low-cost Chinese phones, many Ugandans, particularly the low-income and price-sensitive consumers, are still not able to afford a smartphone, owing to high telecoms sector-specific taxes. Recent adoption of the Excise Duty (Amendment) Act 2018 has also garnered criticism among consumers and ICT stakeholders. The Act imposes a 0.5% levy on withdrawals through mobile money platforms. In addition, it imposes a specific charge of US\$ 200 on over-the-top services per day of data access (GSMA, 2019). This is essentially aimed at taxing the use of social media. Some consider this double taxation, since the government already taxes airtime and data. Moreover, despite the number of telecom operators in Uganda, there is an unequal distribution of ICT services and coverage in the country, with the current ICT infrastructure favouring large companies and urban areas. For instance, although the NBI covers 39 districts (out of 121 in total) with over 2,400 km of fibre-optic cable, it has a relatively low penetration in rural areas. The total cost of mobile ownership, determined by the cost of service usage (voice, data, SMS), activation and handset, in Uganda is also one of the highest in sub-Saharan Africa. Uncoordinated deployment of ICT infrastructure remains a challenge, including lack of an interoperability framework for system integration (UNCTAD, 2018).

Ag-platform model as bridging the gaps: Given a rate of mobile phone adoption that is higher than in the rest of sub-Saharan Africa, along with lower costs of mobile phones and cheaper data bundles, there has been considerable proliferation of Ag-platforms. However, the telecom tax primarily aimed at social media such as WhatsApp has had impacts on the effective use of data, which consequently impinges on the use of Ag-platforms. Production and exchange as well as trading and sharing platforms often have chat systems that enable peer-to-peer transmission of information, which falls outside the purview of mainstream and social media that is taxed. Thus, Ag-platforms can facilitate more open communication channels, which could possibly lead to knowledge spillovers.

Lack of comprehensive e-commerce frameworks: The country does not have a national e-commerce policy but has benefited from the EAC regional harmonised frameworks for cyber-laws enacted in 2011–2013 with the assistance of UNCTAD. Uganda has exhaustive legal frameworks in place, such as the Electronic Transactions Act 2011, the Electronic Signatures Act 2011, the National Information Security Policy 2014 and the Consumer Protection and Competition Bill 2015. The Data Protection and Privacy Bill 2015 remains to be enacted. Most of the main entities in government are involved to some extent in e-commerce, but the general population is not informed on existing legal and regulatory frameworks that protect consumers. Although some regulations are in place, lack of trust and fear of online transactions remain key challenges. Obstacles to establishing an IT or e-commerce business include lack of information and assistance for entrepreneurs (UNCTAD, 2018).

Ag-platform models as bridging the gaps: It is important that Ag-platforms, through the use of blockchains and their practices, assist farmers to entertain increased levels of e-trust. Through a vast array of extension officers and transparent pricing structures, platforms can show that they are more credible than brokers and other middlemen in traditional value chains. In general, almost all models of Ag-platforms attempt to demonstrate that they are reliable and trustworthy. Furthermore, as Ag-platforms store personal data, they often make extra efforts to ensure farmers trust the way the data are used.

However, lack of e-commerce framework hinders the development of Ag-platforms, as farmers are less willing to make online transactions owing to low levels of e-trust. Lack of implementation of consumer protection suggests that Ag-platform firms can charge high rates for their services from farmers, without any governmental capping. This leaves farmers and other users of Ag-platforms in a vulnerable position.

Besides this, the lack of information and assistance for entrepreneurs prevents young entrepreneurs from setting up Ag-platforms.

Lack of investment in downstream marketing: Branding of smallholder farmer products in Uganda requires vertical coordination with aggregating processors or other industrial entities that can vouch for the quality of the final product and be held accountable by consumers when they fall short.

Ag-platform models as bridging the gaps: Ag-platforms through an increase in trust can become entities that carry stamps of credibility and quality. Production and exchange, trading and sharing and guaranteed logistics often have their own surveyors who vouch for the quality of the product, inevitably creating their own standard.

4.1.3 Land governance, gender and youth participation gaps

Land governance: Small land sizes, limited tenure security and land-related disputes have been shown to be critical bottlenecks hampering agribusiness development and commercialisation in Uganda. Currently, about 80% of land is under customary tenure that is undocumented (World Bank, 2018). Furthermore, issues such as land policy (security and tenure and forced evictions), state and customary land management, slum upgrading and informal settlements, land use planning, land conflict resolution and inheritance rights, among others, plague the effective functioning of land markets and have impacts on what to grow, who grows and access to land.

Ag-platform models as bridging the gaps: Ag-platforms can make greater use of GPS data, and of technologies such as drones, to reduce the time and costs of data collection on field boundaries and provide new land maps. Most importantly, this helps farmers create land boundaries to stake a claim of land property rights and to maintain security of tenure, thus increasing their ability to avoid eviction. This also helps with farmer profiling for loans and appears to be a trust-building exercise, as it provides securitisation of land records. The production and exchange, trading and sharing and single buyer-led model offer complex services that include GPN mapping.

Gender equity: As discussed earlier, there exists a significant gender digital divide in terms of access to internet and ICT skills. Many of the reasons for the lack of access are related to socio-cultural norms that are predominant in society. For instance, research in Uganda shows that women are less likely to be given training in ICT skills, and many women cannot afford to purchase ICT-related equipment (Huyer, 2015). Female users currently tend to use fewer services than men and are less confident in using the internet. For instance, while mobile money accounts offer an effective way to boost financial inclusion, it remains the case that fewer women are likely to own and use such an account (GSMA 2020). Additionally, only about 23% of women graduate in engineering and ICT, with lower numeracy skills (UNESCO, 2015).

In the agricultural value chain context in Uganda, women make up about 7% of the agricultural labour force (Aciro Adiiki, 2015) but less than 7% of women own land, with only 1% of women owning land titles (according to the Women Farmers Association of Uganda). Ugandan women access and use the land for cultivation but they do not own the soil they till. Under customary law of tribes like the Langi and Acholi in northern Uganda, every piece of land must be inherited by a son. Similar issues arise when considering widows, who can only inherit 15% land; the remaining property is managed by her husband's brother (Federation of Women Lawyers Association).

Women also face dis-empowerment in the workplace: several studies allude to sexual harassment in Ugandan flower farms by male supervisors (Evers et al., 2014; ETI, 2019) and difficulty for women in joining cooperative groups and obtaining production and growing information as compared with men (ibid). Meizen-Dick et al. (2011) found that female extension agents were more likely to serve female farmers than were male agents (the ratio of women to men was 1.30 for female agents and 0.53 for male agents). *In sum, women struggle with basic entitlements of land rights and freedom of association.*

Ag-platform models as bridging the gaps: All Ag-platforms can act as bridges when it comes to sharing and distributing information, so that everyone has equal access. However, women are more likely to be unable to access mobile devices. Several production and exchange as well as trading and sharing

platforms attempt to support women farmers through selling inputs in smaller batches for crops that women typically grow, as women often have much smaller parcels of land (e.g. this is done by apps such as MyAgro).

Youth participation in agriculture and app development: Recognising the potential of a young population, several donors and incubators are working to bring more youth into agriculture. For example, the United States Agency for International Development (USAID), Syngenta, Iren and the Toyota Kenya Academy have created a forum for youth to present their products to possible investors called the Young Innovators Agribusiness Competition. Kosmos Innovation Centre and Reach for Change's Senegal Start-up Accelerator have provided a half-year of incubation support and €1,800 in seed funding to five youth-led D4Ag start-ups. Furthermore, there has been a significant increase in co-working spaces such as Outbox in Uganda and iHub in Kenya, to engender skill diffusion and training.

Table 11: Ag-platform and policy gaps

Policy gaps	Ag-platforms models	Name of platform	Ag-platforms as bridging policy gaps
<i>Finance and institutional policy gaps</i>			
Misallocation of public spending of agricultural support	Trading and sharing; output exchange; production and exchange	EzyAgric, Kudu, M-Omulimisa	Reducing transaction costs, matching services
Credit and mobile money	Production and exchange; trading and sharing; guarantee purchase and logistics	M-Omulimisa, Evoucher, EzyAgric, NA	Horizontal services through deals with banks, insurance, improving credit availability
<i>Infrastructure gaps</i>			
Road, rail, inland water transport network and power	Guaranteed purchase and logistics; trading and sharing	NA, EzyAgric	Quasi infrastructures, wherein the farmers can access transport infrastructure through the platform
Manufacturing capabilities for agriculture	Production and exchange; trading and sharing; guaranteed purchase and logistics; single buyer-led	M-Omulimisa, EzyAgric, NA, KPOGT	In-app services for subsidised provision of mechanisation
Digital hardware (infrastructure)	Production and exchange; trading and sharing	M-Omulimisa, Viral Cassava android app, EzyAgric	Inbuilt chat system- peer-to-peer transmission of information; knowledge spillovers
Lack of comprehensive e-commerce frameworks:	All	All	Building e-trust through ensuring data privacy, credible information-sharing
Lack of investment in downstream marketing	Production and exchange; trading and sharing; guaranteed logistics	M-Omulimisa, Viral Cassava android app, EzyAgric, NA	Carry stamps of credibility and quality

Policy gaps	Ag-platforms models	Name of platform	Ag-platforms as bridging policy gaps
<i>Land governance, gender and youth participation gaps</i>			
Land governance gaps	Production and exchange; trading and sharing; single buyer-led	M-Omulimisa, Viral Cassava android app, EzyAgric, KPOGT	
Gender equity	Production and exchange; trading and sharing; single buyer-led	M-Omulimisa, Viral Cassava android app	
<i>Gaps in cooperation and partnerships for facilitation and implementation of policies</i>	All	All	Ag-platform models can function more effectively through efficient partnerships
Gaps in resilience of livelihoods: Lack of monitoring and accountability	Production and exchange; trading and sharing	Viral Cassava android app, EzyAgric	Use multiple databases to monitor outcomes and create targeted services for farmers
Limited funds and technical expertise for skill development	Trading and sharing	EzyAgric	Has a financial and input management page within the app to help farmers maintain their books

Source: Authors' construction

4.1.4 Gaps in cooperation and partnerships for facilitation and implementation of policies

Lack of coordination across ministries and other value chain stakeholders: There is a lack of coordination among agriculture-related ministries and agencies; challenges linked to inefficiencies in staffing patterns; weak data collection and monitoring of sector trends; and poor absorption capacity of public institutions. The public extension agency (the National Agricultural Advisory Services (NAADS)) and the public agricultural research agency (the National Agricultural Research Organisation (NARO)), both nominally under the Ministry of Agriculture, Animal Industry and Fisheries (MAAIF) but functionally independent, are at critical turning points. NAADS has been largely side-tracked by the free input distribution mandate (GSMA, 2017; World Bank, 2018). Furthermore, there are tensions in several public–private partnerships, such as the KOGPT project, where there are issues of land grabbing. This has arisen primarily because of a lack of clear coordination between MAAIF and multinational companies Bidco and Wilmar International (FOE, 2012).

Ag-platform models as bridging the gaps: Ag-platforms by design are interdependent in the sense that they can function only through partnership, as shown in each of the models. One organisation alone will not be able to address a host of bottlenecks from financial provisioning to inputs and matching. Thus, there is a need for Ag-platform structures to work with the state-provided infrastructure to enhance value capture potential.

Lack of monitoring and accountability: There is a need to control registration (such as licensing of traders) and to ensure quality certification initiatives such as AgVerify are supported, and the potential for expanding its procedures from seeds to fertiliser assessed (World Bank, 2018). Licensing procedures and import processing for improved inputs and new seed varieties should be enhanced to reduce delays and to foster agribusiness development at the input level. At the same time, there is a need for farmer monitoring and accountability, of working capital loans lent and improved management systems on farms to be able to deliver just-in-time produce. Public databases on key household-level data and agricultural variables such as market prices are also critical to boost national competitiveness and food security and for decision-makers to steer policies in a pragmatic and evidence-based way. There is a need for high-level consideration of what data pertaining to food and agriculture are most relevant, and how they can be collected cost-effectively and analysed in near real time. MAAIF should provide leadership in data collection (e.g. about inputs used, yields, post-harvest losses, soil quality, etc.), management and use to be accessed by a range of stakeholders

Ag-platform models as bridging the gaps: If provided with access to multiple databases and using personal data of farmers, Ag-platforms can develop targeted strategies on how farmers can benefit the most from their services. This is especially useful in apps that use AI, such as versions of production and exchange and trading and sharing.

Lack of digital literacy and skills, especially among the elderly and rural dwellers, is one of the biggest barriers to mobile internet adoption in Uganda. Additionally, ICT infrastructure in schools is limited, despite the introduction of ICT into the education curriculum. Around 43% of respondents in the latest Uganda Bureau of Statistics household survey cited lack of confidence, knowledge or skills as a major reason for not using the internet (GSMA, 2019). As a result, the country depends largely on foreign e-commerce firms while local companies struggle to develop their own digital content and online services (UNCTAD, 2018).

There are notable efforts by different stakeholders to overcome the digital skills gap in Uganda (GSMA, 2019). Although the use of computers is still limited at school, the current National ICT Policy has the objective of providing broadband connectivity to 50% of primary schools by 2020. The Uganda Communication Commission, through the Rural Communications Development Fund, has installed computers for public access in schools, libraries and post offices, and the Maendeleo Foundation, through its Mobile Solar Computer classroom project, is empowering children in rural schools with relevant computer skills. In April 2018, the National Information Technology Authority signed a partnership with SOLVE Incubation and Kafeero Foundation to establish an Information

Access Centre, which will be used to provide digital skills training and create a digital platform for e-learning

Ag-platform models as bridging the gaps: Production and exchange and trading and sharing apps often provide learning by doing digital skills training and often hire a ‘village champion’, who supports farmers with issues that may arise when using the app. Along with this, there is also promotion of soft skills through management of the financial farm records and book-keeping. The apps have book-keeping pages that can help farmers with monitoring and managing their financial flows as well as record inputs consumed.

4.2 Coming a full circle: Policy gaps as a deterrent to the growth of Ag-platforms in Uganda

There is a clear trend that indicates that Ag-platforms can be used as effective stop-gap measures that give governments time to develop longer-term solutions. Many of these platforms as they stand currently would struggle to offer longer-term solutions, unless many of these policy gaps are mitigated. Table 12 highlights some of the main constraints faced by these apps, which prevent effective scaling and proliferation. For instance, almost all platforms reported that lack of support from the government in terms of no subsidies, high costs of borrowing, lack of formal banking and low research and development (R&D) investments, had caused significant distress, inhibiting their sustainability.

Within infrastructural gaps, poor network coverage, lack of digital infrastructure investments and poor warehousing were mentioned as common. Further regulatory gaps, such as unclear data localisation laws, which prevent Ag-platforms from sharing data, lack of local servers, increasing costs of data storage and high costs of using payment systems, have forced many Ag-platforms to reduce the remit of the services they have been able to provide. Finally, unclear land ownership titles and inability of farmers to form strong and well-functioning cooperatives were seen as a significant challenge to the adoption of Ag-platforms. Lack of government support to provide digital training is another example of why farmers have not been able to adopt Ag-platforms. However, one of the most important issues impinging on the sustainability of an Ag-platform is lack of coordination between government agencies.

Table 12: Challenges facing Ag-platforms owing to policy gaps in Uganda

Policy gaps	E-Voucher	Viral Cassava	m-Omulimisa	Kudu	EzyAgric	KOPGT
Finance and institutional gaps	<ul style="list-style-type: none"> - Inefficient subsidies expenditure - Financial instability owing to high cost of borrowing - High cost of mobile money transfers - Low quality chemicals (inability to check) 	Low R&D financial support	<ul style="list-style-type: none"> - High cost of borrowing - Less availability of subsidies for farmers - Low R&D financial support - High cost of mobile money transfers 	Absence of formal banking	<ul style="list-style-type: none"> - High cost of borrowing - Less availability subsidies for farmers - Low R&D financial support - High cost of mobile money transfers - Lack of warehousing facilities 	Lack of micro insurance provision
Infrastructure gaps	Poor network coverage	<ul style="list-style-type: none"> - Poor network coverage - Lack of digital infrastructure investments 	<ul style="list-style-type: none"> - Poor network coverage - Lack of digital infrastructure investments - Lack of transport infrastructure and warehousing facilities 	<ul style="list-style-type: none"> - Poor network coverage - Lack of digital infrastructure investments - Lack of transport infrastructure and warehousing facilities 	<ul style="list-style-type: none"> - Poor network coverage - Lack of digital infrastructure investments - Lack of transport infrastructure and warehousing facilities 	<ul style="list-style-type: none"> - Poor network coverage - Lack of digital infrastructure investments
Regulatory gaps	<ul style="list-style-type: none"> - Poor cyber-security and cyber-crime laws - Lack of payment systems laws - Lack of clear electronic transactions - Unclear data localisation 	- Unclear data localisation laws	<ul style="list-style-type: none"> - Poor cyber-security and cyber-crime laws - Lack of payment systems laws - Lack of clear electronic transactions - Unclear data localisation 	<ul style="list-style-type: none"> - Lack of payment systems laws - Lack of clear electronic transactions - Unclear data localisation 	<ul style="list-style-type: none"> - Poor cyber-security and cyber-crime laws - Lack of payment systems laws - Lack of clear electronic transactions - Unclear data localisation - Lack of marketing and branding, packaging support 	<ul style="list-style-type: none"> - Poor cyber-security and cyber-crime laws - Lack of payment systems laws - Lack of clear electronic transactions - Unclear data localisation

Policy gaps	E-Voucher	Viral Cassava	m-Omulimisa	Kudu	EzyAgric	KOPGT
Land governance, gender and youth participation gaps	<ul style="list-style-type: none"> - Lack of land ownership rights/deeds - Lack of enforced gender-equitable remuneration, wages, and access rights/entitlements policies - Lack of financial and technical support to promote youth uptake of Ag-platforms 	<ul style="list-style-type: none"> - Lack of land ownership rights/deeds - Lack of ability for farmers trade unions and unclear support for cooperatives - Lack of enforced gender-equitable remuneration, wages and access rights/entitlements policies - Lack of financial and technical support to promote youth uptake of Ag-platforms 	<ul style="list-style-type: none"> - Lack of land ownership rights/deeds - Lack of ability for farmers trade unions and unclear support for cooperatives - Lack of enforced gender-equitable remuneration, wages and access rights/entitlements policies - Lack of financial and technical support to promote youth uptake of Ag-platforms 	<ul style="list-style-type: none"> - Lack of land ownership rights/deeds - Lack of ability for farmers trade unions and unclear support for cooperatives - Lack of enforced gender-equitable remuneration, wages and access rights/entitlements policies - Lack of financial and technical support to promote youth uptake of Ag-platforms 	<ul style="list-style-type: none"> - Lack of land ownership rights/deeds - No long-term contracts provided to farmers (precarious conditions of work) - Lack of enforced gender-equitable remuneration, wages, and access rights/entitlements policies - Lack of financial and technical support to promote youth uptake of Ag-platforms 	<ul style="list-style-type: none"> - Lack of land ownership rights/deeds - Land grabbing issues - Precarious contracts for contracted farmers
Gaps in cooperation and partnerships for facilitation and implementation of policies	Poor coordination across ministries to ensure on time subsidies allocations	Short-term partnerships that are unstable and driven primarily by private sector funding	Short-term partnerships that are unstable and driven primarily by private sector funding	Short-term partnerships that are unstable and driven primarily by private sector funding	Short-term partnerships that are unstable and driven primarily by private sector funding	Lead firm controlled and supported, government provides oversight, while private sector develops links to partners

Policy gaps	E-Voucher	Viral Cassava	m-Omulimisa	Kudu	EzyAgric	KOPGT
Gaps in resilience of livelihoods and skills	<ul style="list-style-type: none"> - Limited production, digital and soft skill training - No accountability by government to farmers 	<ul style="list-style-type: none"> - Limited production, digital and soft skill training - No accountability or monitoring structures in place to engender trust with farmers leading to resistance to uptake 	<ul style="list-style-type: none"> - Limited production, digital and soft skill training - No accountability or monitoring structures in place to engender trust with farmers leading to resistance to uptake 	<ul style="list-style-type: none"> - Limited production, digital and soft skill training - No accountability or monitoring structures in place to engender trust with farmers leading to resistance to uptake 	<ul style="list-style-type: none"> - Limited production, digital and soft skill training - No accountability or monitoring structures in place to engender trust with farmers leading to resistance to uptake 	<ul style="list-style-type: none"> - Limited production, digital and soft skill training

4.3 Ag-platforms as a way to plug national policy gaps in Rwanda

4.3.1 Finance and institutional gaps

A long-term policy priority for the government in Rwanda is to raise public revenues using Ag-platforms. A vast majority of the government's revenues come from the collection of VAT, whereas the collection of income tax is very low. There are no plans to levy tax from smallholder farmers but Ag-platforms could represent a way of encouraging farmers to produce the high-value products for export. This would generate further VAT, given that at present staple crops (e.g. rice, wheat, maize) are exempt. Eventually, export taxes could also be applied to export products in order to incentivise domestic processing, but this is not yet an explicit policy priority.

Most projects have clear financial challenges; however, 1AF has proved financially sustainable in the long term. It is estimated that it is now financing 70–90% of the business through its core operations – that is, interest generated on loans to farmers. Although 1AF also receives donor funding, this is used to fund pilots or satellite projects rather than operational expenses. Most other, private-led, projects rely on donor funding or the potential to charge fees for services offered through the Ag-platform. For instance, fees could be charged to the financial institution for every loan completed through the platform. However, the high fees that software developers charge have so far prevented projects from starting on the path towards financial sustainability.

4.3.2 Infrastructure gaps

A more general capacity constraint that affects the technology sector in Rwanda relates to the development of digital infrastructure. Most software developers responsible for the design of Ag-platforms are located outside the country, mostly in Kenya or Israel. These developers have little to no experience working in poor rural areas, meaning that, when user issues arise, it is difficult to address them. This has resulted in greater-than-anticipated resources having to be devoted to front-line support. High fees associated with purchasing the licence to the software have seriously threatened the viability and sustainability of some of the initiatives, including SPARK's Irish potato project. In other cases, data required for knowledge-sharing is also licensed. This was cited as the main difficulty for SWC, which relies on licensed meteorological data from the public agency Meteo Canada. According to the GSMA MCI, Rwanda has network 3G coverage of 95% of the population. Among the rural population, coverage is at a lower rate of 83%, which is likely to reflect marginalisation of the poorest and most vulnerable households. It is also clear that, despite relatively wide coverage, quality is relatively low. Every Ag-platform initiative cited above reported network coverage as a major challenge.

MINAGRI's **Smart Rwanda Masterplan for Digitisation** aims to integrate and streamline the various different government technologies and data resources and develop them more comprehensively. Eventually, this will enable the government to issue fertiliser and input subsidies to farmers. As of yet, there are no plans to expand the penetration and quality of network coverage. Considering that this is the main issue that existing Ag-platforms face, this should be seen as a high policy priority for the government.

4.3.3 Regulatory gaps

There is political will to expand the dairy sector in Rwanda. The country has a natural competitive advantage as a result of its high altitude (which also improves resilience to climate change) and acidic soils but also is located in the world's biggest deficit region for dairy products. As such, the government wants to scale up the Heifer International project, which was initially piloted among 20 cooperatives, covering 17,000 farmers. Plans have been drawn up but, at present, the proposed budget would barely cover an additional 10 cooperatives, given the high costs of hardware, purchase of the software licence from a Kenyan developer and training and/or capacity-building. Meanwhile, the country is beginning to export increasing volumes of dairy products to South Sudan and Democratic Republic of Congo. Similar plans have been drawn up for perennial crops such as coffee and tea. Ag-platforms play a fundamental role in these strategies because they are the only way to link a disaggregated agriculture sector with the demands of international markets.

The above strategy, largely aimed at linking cooperatives and smallholders with international markets using inclusive business models, could be at odds with other plans to attract large-scale investment. Despite strong formal institutions – in 2019 it ranked 40th out of 126 countries in the world on rule of law (WJP, 2019) – Rwanda has struggled to attract investors, because of the limited scale available in the small and densely populated country. At the same time, there are aims to become self-sufficient in rice production. To achieve this, the government is clearing public (i.e. not individually titled) land in lowland areas to attract large-scale investment. There is already a pilot project set up to irrigate 1,600 ha of land to achieve this. Together with MINAGRI, the German Development Corporation (GIZ) is designing software and sensors to collect soil humidity data and develop a fully automated system to record irrigation needs ('smart irrigation'). While these plans have huge disruptive potential, they may also entail negative social outcomes as a result of displacing existing land users in wetland areas. It is important to take this into account, given that various economic and social development indicators have recently begun stalling or plateauing for the first time since the genocide.

There are also gaps related to cooperation and partnerships for the facilitation and implementation of policies. A separate but related issue is that government departments run multiple systems with a great deal of data but a complete lack of integration. For instance, every time MINAGRI requests data from the Rwanda Land Management and Use Authority, this has to be processed manually, even though both departments have digital systems in place. Likewise, even though MINICOM has Ag-platforms that could be used to issue subsidies to farmers, these are strictly restricted to the post-harvest value chain. MINAGRI is responsible for the pre-harvest supply chain and has separate but unrelated platforms to issue advice on fertiliser and inputs.

Lack of integration also affects Ag-platforms aimed at connecting farmers with credit markets. Both SPARK and Heifer International require a manual procedure (at cooperative level), meaning that farmers are not fully connected to financial institutions. This reliance on a manual element also threatens uptake of the technology, since it is often cooperative managers who are reluctant to adopt such technologies. However, the case of 1AF suggests that retaining a manual element can help harness the disruptive potential. The initiative relies on field officers at its hundreds of distribution centres. These officers act primarily as credit agents, as well as recruiting, enrolling and providing training to people who enter the 1AF scheme. Each officer oversees 200–400 farmers but digital platforms are used to scale up and make tasks more efficient, acting as an 'enumerator' for enabling officers to go beyond physical constraints. For instance, those who have the capability to repay loans over their mobile phone can use the platform rather than walking to the distribution centre. Ultimately, however, there is always an option for seeing the field officer in person, which is particularly important for marginalised farmers, who may not have access to mobile phones or network coverage, or may not want to use digital services. The field officer can also enable 1AF to distribute other, potentially more disruptive, technologies to the market, such as by training farmers on how to produce market vegetables or providing solar lights.

Lack of skills provider is an issue that affects government-led initiatives in particular. None of the Ag-platforms operated by MINICOM is functioning properly, owing to constraints in budget and capability. Staff who run the platforms are poorly organised unless pushed. At present, the platforms are unable to fulfil basic needs, such as providing information to farmers on the minimum price for commodities (which is set by the government). These issues have in part been driven by foreign software developers plying government ministries with advanced (and expensive) technological solutions to address basic problems.

Even where mobile coverage exists, populations may not have access to mobile phones, either because they cannot afford them or because they do not have the ability to use the technology. Incentive structures for using Ag-platforms also vary throughout the value chain. For example, those aimed at digitalising farmer financing require a great deal of information from smallholder farmers themselves, including their yields, the price they pay or the volumes delivered. These transactions help financial institutions reliably predict revenue streams, using this instead of collateral to determine how much credit can be issued. Across the initiatives, reluctance to provide such data was reported among farmers, cooperative managers and transporters. Where processes are not transparent or trust does not exist between different actors in the value chain, resistance to adopting Ag-platforms can exist. Lack of demand may also exist as a result

of cultural norms and social attitudes. For example, a knowledge-sharing platform to provide weather information met resistance from farmers who did not consider it possible to predict the weather.

The Heifer International project has attempted to address some of these issues by issuing mobile phones to farmers together with training. However, this approach is costly and is preventing the scaling-up to national level, partly because the costs of capacity-building have been higher than expected owing to low literacy rates (even among cooperative members). These issues are likely to be even more severe among independent smallholders, who tend to be less educated and poorer than cooperative members.

4.4 Coming full circle: Policy gaps as deterrents to the growth of Ag-platforms in Rwanda

Each of the aforementioned platforms faces several challenges that prevent proliferation and efficient functioning of the platforms. Table 13 presents the policy gaps related to the different models of Ag-platforms.

Table 13: Challenges facing Ag-platforms as a result of policy gaps in Rwanda

Policy gaps	SPARK IPoVaF	Heifer International	TechnoServe Coffee Digitisation Project	MINAGRI	1AF	SWC (formerly SFR)
Finance and institutional gaps	<ul style="list-style-type: none"> - Financial instability owing to high cost of borrowing - High cost of mobile money transfers - Low-quality chemicals (inability to check) 	<ul style="list-style-type: none"> - Low R&D financial support - Financial instability owing to high cost of borrowing 	<ul style="list-style-type: none"> - High cost of borrowing - Low R&D financial support - High cost of mobile money transfers 	<ul style="list-style-type: none"> - High cost of borrowing - Low R&D financial support - High cost of mobile money transfers 		High cost of borrowing
Infrastructure gaps	Poor network coverage	<ul style="list-style-type: none"> - Poor network coverage - Lack of digital infrastructure investments 	<ul style="list-style-type: none"> -- Poor network coverage - Lack of digital infrastructure investments - Lack of transport infrastructure and warehousing facilities 	<ul style="list-style-type: none"> - Poor network coverage - Lack of digital infrastructure investments - Lack of warehousing facilities 	<ul style="list-style-type: none"> - Poor network coverage - Lack of digital infrastructure investments - Lack of transport infrastructure and warehousing facilities 	<ul style="list-style-type: none"> - Poor network coverage - Lack of digital infrastructure investments
Regulatory gaps	<ul style="list-style-type: none"> - Lack of payment systems laws - Slow software licence attainment 	<ul style="list-style-type: none"> - Poor and slow software licence attainment - Lack of payment systems laws 				<ul style="list-style-type: none"> - Slow software licence attainment

Policy gaps	SPARK IPoVaF	Heifer International	TechnoServe Coffee Digitisation Project	MINAGRI	1AF	SWC (formerly SFR)
Land governance, gender and youth participation gaps	Lack of land ownership rights and deeds	<ul style="list-style-type: none"> - Lack of land ownership rights/deeds - Lack of financial and technical support to promote youth uptake of Ag-platforms 	Lack of land ownership rights/deeds	<ul style="list-style-type: none"> - Lack of land ownership rights/deeds - No long-term contracts provided to farmers (precarious conditions of work) 	Lack of land ownership rights/deeds	<ul style="list-style-type: none"> - Lack of land ownership rights/deeds - Land grabbing - Precarious contracts for contracted farmers
Gaps in cooperation and partnerships for facilitation and implementation of policies	Poor coordination across ministries	<ul style="list-style-type: none"> - Poor coordination across ministries - Driven primarily by private sector funding 	- Poor coordination across ministries	- Poor coordination across ministries		Lead firm controlled and supported, government provides oversight, private sector develops links to partners
Gaps in resilience of livelihoods	<ul style="list-style-type: none"> - Limited production, digital and soft skill training - No accountability by government to farmers 	<ul style="list-style-type: none"> - Limited production, digital and soft skill training - No accountability or monitoring structures in place to engender trust with farmers leading to resistance to uptake 		<ul style="list-style-type: none"> - Limited production, digital and soft skill training - No accountability or monitoring structures in place to engender trust with farmers leading to resistance to uptake 		- Limited production, digital and soft skill training

5. REGIONAL POLICY GAPS IN THE EAC: AG-PLATFORMS PROMOTING REGIONAL TRADE

Until now the discussion has focused primarily on national Ag-platforms. In-depth research found that over 98% of all platforms within the EAC region exist only within national boundaries. Only one platform, based in Kenya, called Sauti, has facilitated informal cross-border trade for women. Sauti, a mobile-based cross-border trading platform for women, provides information on their rights, the required customs procedures and documentation, making them less vulnerable to corruption and harassment. It collects SMS and USSD trade and market data and provides big data analytics in real time. This has brought many women who relied on the informal market to more formal settings.

This points to a need to understand the various regional policy gaps that prevent the proliferation of apps regionally. This section explains the current state of several Ag-platforms supporting regional initiatives, while simultaneously highlighting various regional policy gaps that currently exist. In this context, we attempt to bring to light how Ag-platforms can bridge regional policy gaps to promote cross-border trade. We look at six policy gaps:

1. Lack of comprehensive Ag-e-commerce regulation (e-transaction laws and payments, data localisation, data protection);
2. Lack of harmonisation of food standards;
3. Lack of intellectual property rights regulation (non-exclusive source-code sharing for software development);
4. Poor financing and mobile payments facilities;
5. Lack of skills development;
6. Inadequate gender equity regulations – enhancing women’s access to business information, finance and capacity-building.

5.1 Lack of comprehensive Ag-e-commerce regulation

Growth in regional Ag-platforms and Ag-e-commerce within the EAC could be a key driver of cross-border trade and development of the region, but this would require building ‘soft’ digital infrastructure in terms of developing appropriate policy and legal frameworks on data-sharing, data privacy, innovation, digital IDs and intellectual property. It would also require associated frameworks on agricultural policy, competition and taxation to foster inclusive digital transformation in the region. While there is no regional e-commerce policy, and none of the EAC countries has a national policy, the region has made progress on a number of important related pieces of legislation – a prerequisite for conducting commercial transactions online.

A particular challenge to cross-border e-commerce is the absence of references to the international aspects of e-commerce. To address this, the EAC’s Electronic Transaction Bill 2014 sets regional standards in relation to electronic signatures, e-government services, consumer protection and the limitation of liability of service providers. Countries have committed to developing consumer protection legislation relating to e-commerce within the Bill: Kenya, Rwanda and Uganda have online consumer protection laws in place, with draft legislation in Burundi and Tanzania. However, these are not yet harmonised regionally. Alignment of national laws with the EAC Bill remains mixed, with some deviations in each country and lack of sufficient regional harmonisation/perspective in many.

In addition to this, EAC member states have adopted e-transaction policy recommendations to be domesticated by through the development of regulatory frameworks. Other e-commerce-related tools operational in the EAC include a website for the report and resolution of non-tariff barriers, biometric passports and the East African Cross-Border Payment System (EAPS). Through Article 8 of the Protocol on the Establishment of the EAC Common Market, EAC partner states have committed to work progressively towards, ‘a common standard system of issuing national identification documents to their nationals’. The six EAC states are also at varying stages of introducing new or strengthening existing

national ID systems, and Kenya, Rwanda and Uganda already recognise each other's national IDs as valid documents in lieu of a passport, which can facilitate digital trade across cross-border businesses.

Currently, there is no regional data localisation law within the EAC, but Rwanda developed a Data Revolution Policy in 2017, covering the cross-border flow of data, data-sharing, use of personal data and data localisation. While Kenya does not currently have a national data protection authority, there is draft legislation in the Senate – the Data Protection Bill 2018 – that aims to establish such an authority. Some aspects of this draft Bill are, in principle, similar to Rwanda's. Kenya's draft Bill prohibits the transfer of personal data out of Kenya, unless the third party is subject to a law or agreement that requires putting in place adequate measures for the protection of personal data; unless the data subject consents to the transfer; unless the transfer is necessary for the performance or conclusion of a contract between the agency and the third party; or unless the transfer is for the benefit of the data subject. Rwanda's data policy states that Rwanda has exclusive sovereignty on national data but includes a provision of hosting data in a cloud or collocated environment in data centres within or outside Rwanda, under agreed terms, and governed by Rwanda. MTN in Rwanda was recently fined \$8.5 million (10% of its annual turnover) for breaching its licence and maintaining Rwandan customers in Uganda (Reuters, 2017). Uganda has also passed a draft bill on data (2015); however, it diverges widely from Kenya's (World Bank, 2019).

A single EAC law on data protection, based on the Convention on Cybercrime and Personal Data Protection of the African Union (adopted in 2014), could be an effective means of improving and harmonising existing regulation (UNCTAD, 2016). The Northern Corridor Integration Projects (NCIP) has a working group on inter-governmental data-sharing. Through this initiative, Kenya, Rwanda and Uganda have reportedly agreed to harmonise the related regulatory framework, enabling data-sharing on common terms. South Sudan is in the process of developing similar regulation. This framework defines both which data can be shared and what protocols must be followed. It will, for example, allow for the integration of national ID and sim card registration databases. There is also a lack of supporting regional infrastructure in most of East Africa. A mere six major commercial data centres are located in East Africa (five in Kenya and one in Tanzania), out of some 4,124 co-locations reported globally.⁴ The largest is the East Africa Data Centre, a carrier-neutral facility, built by a subsidiary of Liquid Telecom.

Supporting regional Ag-platform models: The expansion and strengthening of the EAPS and e-transaction laws are critical to the growth of Ag-platforms. All models of Ag-platforms use mobile payment systems, thus resolving cross-border payments structures can smooth their functioning. Additionally, the lack of regional data localisation prevents the sharing or use of data collected by Ag-platforms in one country with another EAC country partner. There is a need to promote the NCIP working group framework to support a data-sharing commons within the EAC.

5.2 Lack of harmonisation of food standards

Standards are required to consider the protection of consumers and plant and animal health. However, to date there have been significant challenges in attempts to harmonise national standards with those of the EAC. States exercise the right to protect consumers, plant and animal safety, thus make regulations in their territory. These regulations differ from those of the EAC, inhibiting harmonisation and creating technical barriers to trade. The EAC's Standardisation, Quality Assurance, Metrology and Testing (SQMT) Act 2006 works to facilitate trade within the EAC. By 2013, the EAC had managed to harmonise about 1,240 standards, which is low, as partner states may have as many as 6,000 national standards. Despite efforts made in this regard, the provisions of the SQMT Act have not been fully implemented. Much still needs to be done to establish trust in inspection, testing and certification conducted by the other EAC countries to establish mutual recognition. Challenges in implementation include reluctance by states to adopt EAC standards and lack of financial and technical resources. There is a need to fast-track harmonisation through the approximation of respective national standards laws to the SQMT Act (Tharani, 2017). This reduces the overall expenses of cross-border trade, while increasing the volume.

⁴ <https://www.datacentermap.com/>

Supporting regional Ag-platform models: All models of Ag-platforms (except single buyer-led, which may use own private standards) would benefit significantly from harmonisation of standards. This will enable them to use the common market to sell goods at competitive prices to other EAC countries, while also expanding their customer base.

5.3 Intellectual property

At the national level, many East African countries do not have fully developed intellectual property (IP) laws, resulting in issues around comprehensibility and enforceability of IP laws, particularly related to trade in illicit, substandard and counterfeit products in African countries. Consider the case of Kenya, which already has a legal framework for protecting IP rights (IPR) (such as laws on trademarks, industrial designs and copyright), which complies with international IPR rules. To prevent copyright and digital content piracy, the Kenya Copyright Board is working on the Copyright Amendment Bill (Okal, 2017), which will facilitate protection of creative works on online platforms, enabling greater digital trade. Moreover, Kenya launched the Cyber Security and Protection Bill in 2016 to provide increased security in cyberspace, enabling greater information-sharing and protection of life and national security (ibid.). But Kenya continues to face a number of challenges on IP owing to lack of a comprehensive national policy (Banga and te Velde, 2018).

At the regional level, IPR issues are not harmonised but efforts are being made to assist EAC states to implement the TRIPs Agreement with a view to promoting copyright and cultural industries, traditional knowledge, geographical indications and technology transfer (UNECA et al., 2019). Managing innovation in the digital age will also require updating competition policies at the national and regional levels with a clear understanding of (i) the ‘network effect’ of platforms along the value chain; (ii) changing business models; (iii) the role of the internet in intermediation and disintermediation; and (iv) defining the relevant market in the digital age.

Supporting regional Ag-platform models: It may be more feasible and realistic to achieve regional economic integration in IPR, including through (i) arrangements for regional cooperation and sharing of experiences on IPR; (ii) regional filing systems, usually for patents, but also for trademarks and industrial designs; and (iii) development of one substantial law or unification of laws for members of a regional organisation (UNECA et al., 2019).

5.4 Poor regional financing and mobile payments facilities

Regionally, no interoperable mobile payment system exists in the EAC; mobile payment systems are mainly domestic, limited to a single operator’s network (World Bank, 2019), which often experiences limited operability with other domestic operators as well. Kenya’s Safaricom is one of the few operators to have enabled international money transfers. Registered M-Pesa subscribers can send money to Vodacom Tanzania, MTN Uganda and MTN Rwanda subscribers. Transfers are received in local currency, with conversion rates and fees advertised in a text message before money is transferred. Greater interoperability as well as lower cross-platform and cross-border transaction fees could foster a regional digital payment ecosystem. The World Bank is helping develop supporting ICT infrastructure that links regional stock exchanges across the EAC, as well as settlement and depository facilities, which could facilitate interoperability.

Supporting regional Ag-platform models: Ag-platforms are usually run by MSEs, and thus need to depend heavily on a few operators, such as MTN and Vodacom, for their operations. This forces them to have to subscribe to specific mobile payment systems, which are not necessarily interoperable between countries. This reduces their ability to perform cross-border transactions effectively. At the same time, the monopoly created by such operators increases the overall cost of doing business for all Ag-platform models. Therefore, it is important to fast-track the creation of regional MSE cost protection mechanisms that prevent extraction of monopolistic rents.

There is a need to scale up financial inclusion labs. For instance, through MasterCard’s Farmers Network (formerly known as 2Kuze) e-marketplace in Kenya, Uganda and Tanzania, there can be support to systemically integrate smallholder farmers regionally from loose value chains with quality buyers via a

digital transaction marketplace for individual sellers and buyers. This can be performed through integrated MasterCard-led payment digitalisation.

Another important aspect worth noting is the need for structured insurance, especially climate insurance to protect farmers, on a regional scale. Very few companies have successfully offered such services across borders. One such insurer is ACRE Africa, which has partners in Kenya, Rwanda and Tanzania, and has developed a suite of products that enable farmers to handle climate risk using a state- and satellite-based weather index, area yield index, hybrid weather index, multi-peril crop insurance and dairy livestock insurance. Its success has been attributed to the fact that it bundles insurance with other solutions (e.g. input credit) and sends pay-outs to farmers using mobile money.. Evidence suggests that farmers who were clients of ACRE Africa invested 20% more in their operations and generated 16% more income than did those farmers who were not insured (Tsan et al , 2019).

5.5 Lack of regional skill development and gender equity

Lack of familiarity and training are often cited as a key barrier to tech adoption; lack of digital skills was cited as the main reason for not going online by 45% of those surveyed in Tanzania and 37% of those surveyed in Kenya in a recent GSMA survey.⁵ Gaining basic digital skills is an even greater challenge for those who also lack basic literacy, which is estimated to be roughly 15–30% of the population in most East African countries and far higher in South Sudan (World Bank, 2019). Very few regional initiatives exist on digital skills development in the EAC. One example is the Maarifa Centres, established by the Arid Lands Information Network across Kenya, Uganda and Tanzania. These train local communities in basic digital skills that are directly relevant to them – such as how to use mobile phone applications to improve incomes from agricultural production (ibid.). Another example is UTouch, which operates ‘digital centres’ in remote villages in Uganda.⁶

The lack of tenure security, the burgeoning gender digital divide and complex cross-border trade requirements often prevent women from participating in regional trade. Furthermore, there is currently no mandate or protection for women (e.g. harassment at borders, lower prices paid), who tend to participate actively in cross-border trade. Some apps, such as Sauti, a mobile-based cross-border trading platform for women, provides information on their rights, the required customs procedures and documentation, making them less vulnerable to corruption and harassment (Sauti Africa, n.d.). Along with this there is a reporting function on the app through which women can report crimes committed against them. The platform collects SMS and USSD trade and market data and provides big data analytics in real time. This has brought many women who relied on the informal market to more formal settings

Supporting regional Ag-platform models: The EAC needs to create specific ‘gender budgets’ and improve the implementation of ‘gender mainstreaming’, especially in relation to ICT skilling, and access to digital products, and incentives on uptake, in all its digital programmes. For instance, Article 5(e) of the Treaty covers issues of gender mainstreaming into all EAC endeavours, whereas Articles 121 and 122 emphasise the role of women in socio-economic development in the states. There is a need to scale up regional financing for women entrepreneurs through initiatives such as 50 Million African Women Speak, by promoting more targeted funding to apps that can serve and understand the cultural and societal norms of women workers.

In sum, there is a clear impetus for harmonisation and implementation of existing regional policies, and for the creation of new regional laws that can support the proliferation of all models of Ag-platforms regionally. Several issues, ranging from lack of interoperability to poor cross-border payment systems, are hindering the expansion of Ag-platforms across borders.

⁵ <https://www.gsmainelligence.com/>

⁶ <https://u-touch.org/>

6. TAKEAWAYS FOR POLICY-MAKERS: AG-PLATFORM ROADMAP

6.1 Key takeaways

This section summarises the report by providing five key takeaways and presents policy-makers with an Ag-platform roadmap, which attempts to combine the win/win strategies to create customised and targeted Ag-platform models that create value creation and capture opportunities.

Takeaway 1: Five business models of Ag-platforms

Combining the scope (that is, the breadth of services that substitute for or complement traditional functions and processes in an agricultural value chain) and scale (different end markets) leads to creation of the five most common Ag-platform forms:

1. *Production and exchange model*: Three scopes – backward exchange, horizontal offers and information services – where farmers gain production-related information, sometimes along with AI and big data analytics support. Generally, occurring at the pre-production and production stage of the value chain.
2. *Output exchange*: Midstream in the value chain, with three scopes – forward exchange, post-harvest and information services. This is an auction-based model, wherein farmers are provided information on crop prices and logistic prices to transport products, as well as post-harvest services such as grading and packaging.
3. *Trading and sharing*: Five scopes – marketplace matching, horizontal offers, information services and complex information services, production and harvest services, and sharing and knowledge exchange. This model covers the full value chain, as it includes services from the pre-production stage to the output sale.
4. *Guarantee purchase and logistics*: Two scopes – guaranteed purchase and prices and information services. In this case, Ag-platform firms act as intermediaries and buyers, by taking the onus of loss onto themselves. They provide farmers with contracts, along with a guarantee of purchase at specific market defined prices.
5. *Single buyer-integrated*: A completely vertically integrated value chain, wherein the main off-taker, be it a processor or a retailer, directly controls the entire value chain and there is already a predetermined market (i.e. prior contract with final buyers already exists).

Takeaway 2: Value creation and capture opportunities

Opportunities include Ag-productivity gains, value addition and diversification, creation of more, decent and formal jobs for youth, gender inclusion and knowledge accumulation and absorptive capacity. In the case of Uganda, trading and sharing platforms showed the most improvement in terms of productivity, value addition/diversification, number of jobs created and gender inclusion; these were followed by production and exchange, single buyer-led and output exchange. Productivity appears to have increased for almost all Ag-platform models, in terms of crop yields as well as improvements in farm management practices and labour productivity. Value addition/diversification appears to have improved across trading and sharing and production and exchange Ag-platform models, with farmers seen to upgrade by diversifying to new products. An important feature identified is the low number of jobs created, except in the case of one trading and sharing app, which tapped into a new customer base of urban and peri-urban professionals who also farm as a side-business. Additionally, it is important to note that most of the new jobs are taken up by youth, who are now interested in returning to farming. There is a clear trend of low female participation/gender inclusion on Ag-platforms, owing to lack of mobile phones (e.g. the male member in the family owns and uses the phone).

Takeaway 3: Ag-platforms as a bridge for national policy gaps in the short term

Trading and sharing and production exchange Ag-platforms come out on top when it comes to bridging national policy gaps related to fiscal and institutional policy. Guaranteed purchase and logistics models of Ag-platforms would work successfully to fill the infrastructural deficits of road and rail and take all the risks

onto them to transport and sell farmers' produce. Similarly, trading and sharing platform come out on top when it comes to filling deficits of lack of governmental support of upskilling, by providing capacity-building themselves, and supporting knowledge spillovers through peer-to-peer chats that fall outside the remit of the transaction tax.

Takeaway 4: However, lack of narrowing national policy gaps in the long term can create challenges for Ag-platforms and threaten their survival

For instance, almost all platforms reported that lack of support from the government in terms of no subsidies, high costs of borrowing, lack of formal banking and low R&D investments had caused significant distress, inhibiting their sustainability. Within infrastructural gaps, poor network coverage, lack of digital infrastructure investments and poor warehousing were mentioned as a common problem. Further regulatory gaps, such as unclear data localisation laws, which prevent Ag-platforms from sharing data, lack of local servers, increasing the costs of data storage, and high costs of using payment systems have forced many Ag-platforms to reduce the remit of the services they are able to provide. Finally, unclear land ownership titles and inability of farmers to form strong and well-functioning cooperatives were seen as a significant challenge to the adoption of Ag-platforms. Lack of government support to digital training is another reasons farmers have not been able to adopt Ag-platforms. However, one of the most critical issues related to Ag-platform sustainability is lack of coordination between government agencies.

Takeaway 5: Regional policy gaps and support to Ag-platforms

In-depth research found that over 98% of all platforms within the EAC exist only within national boundaries. This points to a need to understand the various regional policy gaps that prevent the proliferation of apps regionally. Creating more comprehensive Ag-e-commerce regulation through strengthening the EAPS; improving data protection protocols; clarifying data localisation requirements; and implementing the SQMT Act 2006 can support harmonising standards and ease the diffusion of Ag-platforms cross-border. Sharing source-codes, improving interoperability between mobile operator systems, supporting regional ICT skilling initiatives and enhancing the 50 Million African Women Speak agenda are key ways to increase women's participation in the digital space.

6.2 Designing win/win Ag-platforms through the five business models: roadmap for policy-makers

This report has encapsulated the various contexts in which different models of Ag-platforms thrive or perish. As we have seen, when accounting for value capture opportunities, productivity increase is most common in trading and sharing and production and exchange platforms, whereas gender inclusion occurs more commonly in trading and sharing models. When accounting for national policy gaps, for instance, trading and sharing often acts as a quasi infrastructure instrument filling infrastructural policy gaps, as well as providing skills development, over the short run, but will suffer over the long run owing to lack of government support in ICT and soft skills as well as poor quality road, rail, power and digital infrastructure.

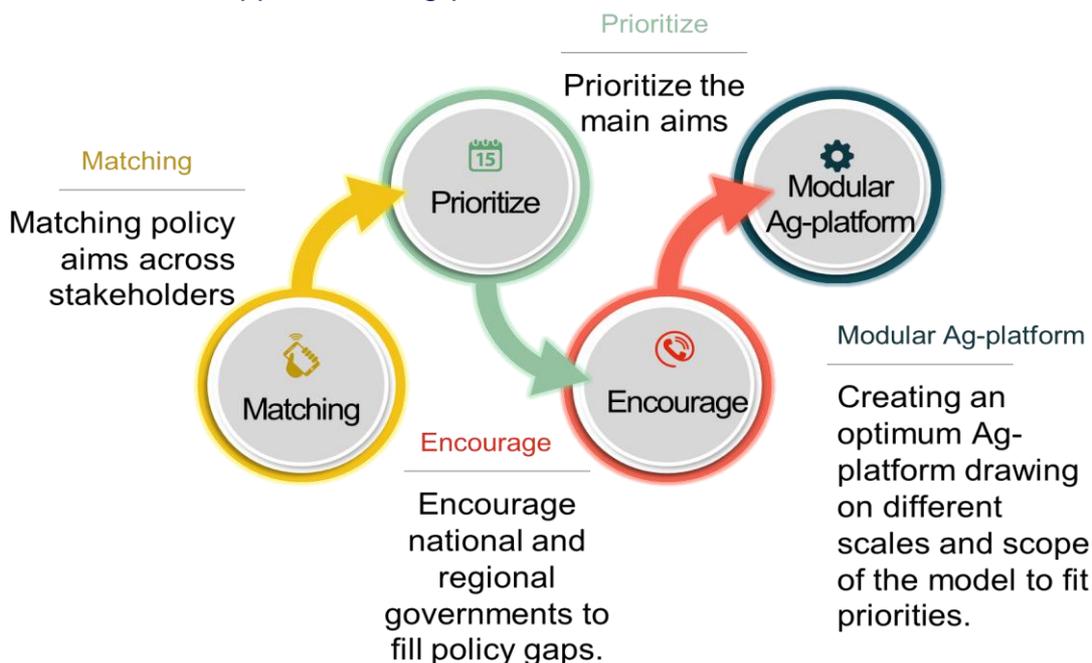
Overall, we illustrate three main issues:

1. The need to expand value creation and capture opportunities;
2. The importance of bridging national policy gaps;
3. The role of the EAC in supporting the proliferation of Ag-platforms to increase regional trade.

In order to create Ag-platform models that are able to maximise value creation and capture, to overcome national policy gaps and to be able to trade regionally, there is a need to account for all the objectives, and carve out under what circumstances and conditions some Ag-platform models can be more successful than others. Arriving at the optimal Ag-platform model that looks at all the concerned objectives leads to the creation of win/win stories. It is important to consider creating an optimal Ag-platform model because of the large number of platform firms that have failed to take off or close after the pilot. This is because many firms use technocratic, one-size-fits-all approaches to designing the platform. But, as this report has shown, the implications for Ag-platforms and created by Ag-platforms vary significantly in different

contexts. Figure 6 illustrates a four-step process to begin creation of a customised Ag-platform that suits specific needs in specific contexts to enhance the probability of success and long-term sustainability.

Figure 6: Modular approach to Ag-platforms



Source: Authors' construction

Step 1: Matching policy objectives/issues across stakeholders. These policy aims can range from ensuring value creation opportunities to narrowing national/regional policy gaps.

Step 2: Prioritising objectives. The aim here is to hold various stakeholder meetings to understand which policy objectives/issues need to take highest priority. For instance, if considering the expansion of Ag-platforms in Uganda, it is important to align with Uganda 2040 vision plans and ensure improvement in agricultural productivity, diversification and creation of jobs.

Step 3: Encouraging national and regional governments to begin implementing or fast-tracking laws in areas where policy gaps severely impinge on the diffusion of Ag-platform models. For instance, in the regional case, issues related to mobile payments, cross-border transactions and interoperability are important factors preventing the expansion of Ag-platforms into regional markets.

Step 4: Using all the above information, scope by scope, to attempt to create a unique Ag-platform model that works. For instance, a new Ag-platform – that does not already exist – can be created. If the aim is to maximise productivity and diversification, it is best to create a model that considers aspects of both production and exchange as well as trading and sharing, as both these models lead to increases in value creation. **Therefore, in sum, policy-makers can mix and match different 'scales' and 'scopes' or even existing business models of Ag-platforms, to create unique platforms to serve specific purposes.** This suggests that finding an Ag-platform model that works for specific policy priorities occurs in a 'modular' way – that is, by adding each module (each scope) separately to form a new model. This can ensure that Ag-platform models are sustainable over a longer term.

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APPENDIX A: LIST OF INTERVIEWS IN UGANDA

Organisation	Type of stakeholder
EzyAgric/Akoiron	Ag-platform, private sector
Uganda Cooperative Alliance	Civil society
Ministry of Science, Technology and Innovation	National government
Ministry of Trade	National government
Ministry of Agriculture, Animal Husbandry and Fisheries	National government
AGRA	Civil society
Makerere University	University
Oil Palm Association	NGO and quasi-governmental
Uganda Warehousing Receipt System Authority	Government organisation
Akello Banker	Ag-platform, private sector
Makerere University	Ag-platform, private sector
M-Omulimisa	Ag-platform, private sector
Technoserve	Civil society
CTA, Netherlands	International organisation
MUUIS	Ag-platform, private sector
DFID	International organisation
OutBox	Co-working space
MTN	Private sector
Syngenta	Private sector
USAID	International organisation
SNV	International organisation
UNEP	International organisation
EAC	Regional government
GIZ	International organisation
IFAD	International organisation

APPENDIX B: LIST OF INTERVIEWS IN RWANDA

Organisation	Type of stakeholder
Ministry of Finance	National government
Ministry of Agriculture	National government
Rwanda Land Management and Use Authority	National government
DFID	International organisation
Heifer International	Foundation
IGC	Think tank
1AF	Private firm
Kumwe	Private firm
GIZ	International organisation
SWC, formerly Smart Farming Rwanda (SFR)	Private firm
Spark – IPoVaF	Private firm
Ministry of Commerce	National government
Agri Pro Focus	Private firm
Baza Farms	Private firm
AgriGo or Go	Private firm
FAO Rwanda	International organisation
SMAgri	Private firm
Kiza Agri	Private firm