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# Ag-platforms as disruptors in value-chains: evidence from Uganda

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Cover photo: Farmers using AgriTech platform in Uganda. © CTA ACP-EU/Flickr

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1 The Enhanced Integrated Framework (EIF) is the only multilateral partnership dedicated exclusively to assisting least developed countries (LDCs) in their use of trade as an engine for growth, sustainable development and poverty reduction. The EIF partnership of 51 countries, 24 donors and eight partner agencies works closely with governments, development organisations, civil society and academia. The partnership leverages its collective know-how, outreach and experience to tackle the world's most pressing trade-for-development issues.

# About this report

ODI is releasing a series of working papers and reports funded by the Enhanced Integrated Framework (EIF), as shown in the table below. These explore AgriTech in East African value chains. This is the fourth in the series, as highlighted below.

| Working Paper/Report | Outline |
|---|---|
| Report 1: Disruptive technologies in agricultural value chains: insights from East Africa (ODI Working Paper; March 2020) | Conceptual paper on what disruption means within AgriTech, who is disrupted and how. It also shows various pathways to value capture and creation that emerge as a result of disruption (www.odi.org/publications/11460-disruptive-technologies-agricultural-value-chains-insights-east-africa). |
| Report 2: Platforms in agricultural value chains: emergence of new business models (SET report; July 2020) | This report describes various models of agricultural platforms and provides policy-makers with an ag-platform roadmap, enabling them to optimise the development and use of these platforms (https://set.odi.org/platforms-in-agricultural-value-chains-emergence-of-new-business-models/). |
| Report 3: Platforms in agricultural value chains: national and regional policy gaps (SET report; July 2020) | This report aims identify the various national and regional policies required to ensure the proliferation of Ag-platforms and also how Ag-platforms can be used to bridge national and regional policy gaps (https://set.odi.org/ag-platforms-in-east-africa-national-and-regional-policy-gaps/). |
| **Report 4: Ag-platforms as disruptors in value chains: evidence from Uganda** | **This report uses survey data to explain the causal factors that affect 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 lists the 10 key interventions for donor investment that would maximise the value creation and capture potential of ag-platforms for the poorest people. |

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# Acronyms and abbreviations

| | |
|---|---|
| **ag-platform** | agricultural digital platform |
| **AgriTech** | agricultural technology |
| **ASSP** | Agriculture Sector Strategic Plan (for investment) |
| **B2B** | business-to-business |
| **B2C** | business-to-customer |
| **CTA** | Technical Centre for Agricultural and Rural Cooperation |
| **EAC** | East African Community |
| **EIF** | Enhanced Integrated Framework |
| **GDP** | gross domestic product |
| **HH** | household head |
| **ICT** | information and communication technology |
| **KACE** | Kenya Agricultural Commodity Exchange |
| **m-apps** | mobile applications |
| **MIS** | management information system |
| **MNO** | mobile network operator |
| **NUCAFE** | National Union of Coffee Agribusiness and Farm Enterprises |
| **SACCO** | Savings and Credit Cooperative Society |
| **TVET** | technical and vocational education and training |
| **UCA** | Uganda Cooperative Alliance |

# Executive summary

- Agricultural digital platforms (ag-platforms) can play an important role in African countries' response to the Covid-19 pandemic. Ag-ecommerce, in particular, is emerging as a critical channel for market access during the pandemic, fuelled by social distancing measures and the shift to cashless transactions and mobile money.
- There is strong evidence that ag-platforms can enhance productivity gains, increase access to services that enhance productivity (such as training and financial services), and promote diversification, particularly into new markets.
- But a digital gender divide that persists among platform users prevents effective value capture, and may be compounded by major barriers such as insecure tenure, social norms, institutional constraints and intra-household dynamics.

The government of Uganda has containment measures in place to tackle Covid-19, including quarantine, bans on public gatherings and weekly markets, school and border closures, suspension of international flights, a ban on internal movement and the closure of non-essential retail outlets. These measures have had a negative impact on businesses in agriculture, as shown by the Ugandan Business Climate Index (EPRC, 2020), with 71% of agricultural firms reporting a severe decline. Digital platforms have become increasingly important tools for spreading information about the pandemic and health and safety measures; increasing access to input suppliers and customers, extending social protection to the poor, and delivering training to farmers, both online and remotely.

This report takes a deep dive into ag-platforms and examines ways in which their economic value can be captured by, and include, farmers, youth and women in Ugandan agricultural value chains. It draws on research that is the first of its kind for Uganda, presenting empirical evidence on the landscape of ag-platforms, the extent to which they have facilitated or inhibited value capture, and their impact on the productivity of farmers. The report consolidates survey data from 821 farmers in Uganda, complemented with stakeholder insights gathered through interviews with a range of actors, including government officials, cooperatives, buyers, brokers, donors, input suppliers, co-working space managers and mobile operators, as well as a range of ag-platforms.

Survey data from the farmers suggest that the main incentive for registering on ag-platforms is to find new buyers – a factor cited by 20% of ag-platform users. This is followed by access to advisory/extension services and information on prices and weather (15.7%); obtaining working capital or loans (14.3%) and access to better inputs (14%). While a higher share of both men and women on the platforms have access to internet than non-platform users, a digital gender divide persists; 38.17% of men report having access to the internet, compared to 22.4% of women using ag-platforms.

**The survey finds that farmers on ag-platforms have greater access to productivity-enhancing services, such as training services and financial services.** Over 70% of platform users have access to agricultural training on planting, fertiliser use, post-harvest maintenance and health and safety, compared to less than 45% of non-platform users. The share of ag-platform users that have access to capital and commercial loans is also higher by 20 percentage points than for non-users.

Women and young farmers who are on ag-platforms appear to be doing better than those who are not; only 12.5% of female farmers and 17% of young farmers who use the platforms report that they have no access

to training, compared to 46% of female and 40% of young non-platformised farmers. Even after accounting for self-selection, we find that platform farmers are significantly more productive than they would be if they were not on the platforms. For our sub-sample of maize producers, we find that on average, the crop yield of platform users is far higher – by 18% – than for non-platformised maize producers. There is, however, a gender gap among farmers on these platforms, with male maize farmers having significantly higher yields than female maize farmers.

**Participation on ag-platforms is found to facilitate access to multiple new markets but may offer fewer opportunities for product diversification.** In all, 23.44% of platform users have diversified into new markets, compared to only 19% of non-users. However, a lower percentage of users have diversified into new products compared to non-users, which raises questions about the ability of ag-platforms to promote product diversification.

**Ag-platforms have increased access to formal work, particularly for women and youth, but the share of women and young platformised farmers who receive a contract remains critically low.** This indicates that buyer–farmer relationships have not been formalised to the extent of providing giving contracts, which implies low trust in online services and e-commerce and limited cohesion in the relationship. Nevertheless, a contract is more likely for platform users. We find that 20% of platform users receive a contract for their produce, compared to less than 10% of non-platform users. Women on platforms seem to have higher access to formal work than women who are not on platforms; 21% are given a contract for their produce and 49.5% have access to working capital loans, as compared to 9.32% and 29% of non-platformised female farmers respectively. Similarly, 17% of young platform users receive a contract for the produce, compared to 14.5% of young non-platformised farmers in the sample.

**Gains from ag-platforms depend on their business model.** Roughly 62% of platform users in the Ugandan sample are classified as operating under the 'production and exchange' model, in which farmers gain production-related information at the pre-production and production stage of the value chain. Around 11.31% of the platform users are classified under the 'trading and sharing' model, which covers the full value chain, as it includes services from the pre-production stage to the output sale. Only 1.61% of platform users are classified under the 'integrated single-buyer' model, which is a vertically integrated value chain, where the main off-taker controls the entire value chain directly and there is a predetermined market. The research finds that the production and exchange model fares better than the other models in terms of opportunities to diversify; that the 'trading and sharing' model works better for crop productivity; and that the integrated single-buyer model is better for access to working capital.

The research suggests that the following approaches are needed to leverage ag-platforms effectively for post-Covid-19 economic recovery:

- greater institutional oversight to check quality standards
- greater access for farmers to working capital
- measures to address logistical and storage challenges to improve farmers' incomes
- measures to increase the effectiveness of farmers' groups
- establishing targeted initiatives to increase access to digital and soft-skills training for young farmers.

# 1 Introduction

The digital economy is opening up new ways and opportunities to extract higher 'value' from agriculture. Data analytics, biotechnology and communications, for example, are improving yields on farms while digital platforms are helping farmers to boost the efficiency of their agricultural supply chains and access new markets. The main AgriTech innovations in use today in developing countries are digital platforms, such as mobile and web apps that are used for information and for financial and commodity transaction processes along agricultural value chains (Krishnan et al., 2020a).

New value-creation opportunities are now being created to help farmers increase their productivity, add value and diversify, and increase their market access and trade, while boosting employment and income opportunities, as well as gender and youth inclusion. These new opportunities are now possible through the use of ag-platforms: digital transaction platforms that are, in effect, third-party applications (apps) developed primarily to facilitate transactions between two or more user groups (Koskinen et al., 2018).

Uganda provides a useful case study for the examination of the potential of ag-platforms. The country's agriculture is seen as a key sector for future economic growth and economic inclusion, with Uganda's Vision 2040 and the new Agriculture Sector Strategic Plan (ASSP) for investment, both of which prioritise agriculture as a conduit to economic transformation. Agriculture continues to account for 25% of Uganda's gross domestic product (GDP), employs 70% of the population, and accounts for half of the country's export earnings (World Bank, 2017).

Given that most Ugandans live in rural areas and practise farming, it is crucial to increase agricultural incomes if the country is to reduce poverty, boost prosperity and create jobs, particularly for women and youth. Women make up 55% of the economically active population in agriculture, contributing more than 75% of the total farm labour and over 90% of farm-level primary processing operations. At the same time, almost half (45%) of the heads of smallholder farming households are under the age of 40.

While other countries in the East African Community (EAC) have seen their agricultural output grow by around 3–5% per annum over the past five years, national agricultural output in Uganda has grown by only 2% (World Bank, 2017). Agriculture continues to be affected by underlying issues such as a rapidly growing population and youth unemployment in rural areas, despite the country's increased urbanisation (Krishnan et al., 2020a). The already limited adaptive capacity of rural communities has been exacerbated by growing population density, combined with continued land and water degradation and the low quality of agricultural inputs in the absence of adequate on-farm investments.

In terms of digital readiness, particularly mobile connectivity, Uganda ranks lower than Kenya and Rwanda in the EAC (Krishnan et al., 2020b). However, it ranks high in the World Bank's Ease of Doing Agriculture Index and ranks second only to Kenya in the EAC in terms of its regulatory framework for digital readiness, measured by the dimensions of its regulatory authority, mandate and regime, as well as its competition framework (ITU, 2018). Uganda has also developed e-transaction systems, consumer protection, cyber-crime prevention regulations, and a draft data protection and privacy act (Krishnan et al., 2020a). Nevertheless, there is considerable scope for improvement within information and communication technology (ICT) practices in terms of unbundled operating and spectrum licenses for mobile network operators (MNOs), the renewal criteria for licenses and the legal sharing of active and

passive infrastructure between MNOs, where Uganda falls behind Tanzania and Kenya.

Various forms of AgriTech are found in Uganda. ODI has collated data from 28 firms in Uganda (Figure 1). The majority of these firms – around 74% – fall into the data-connected device category, which includes ag-platforms and the related use of software to digitally connect devices in a platform.

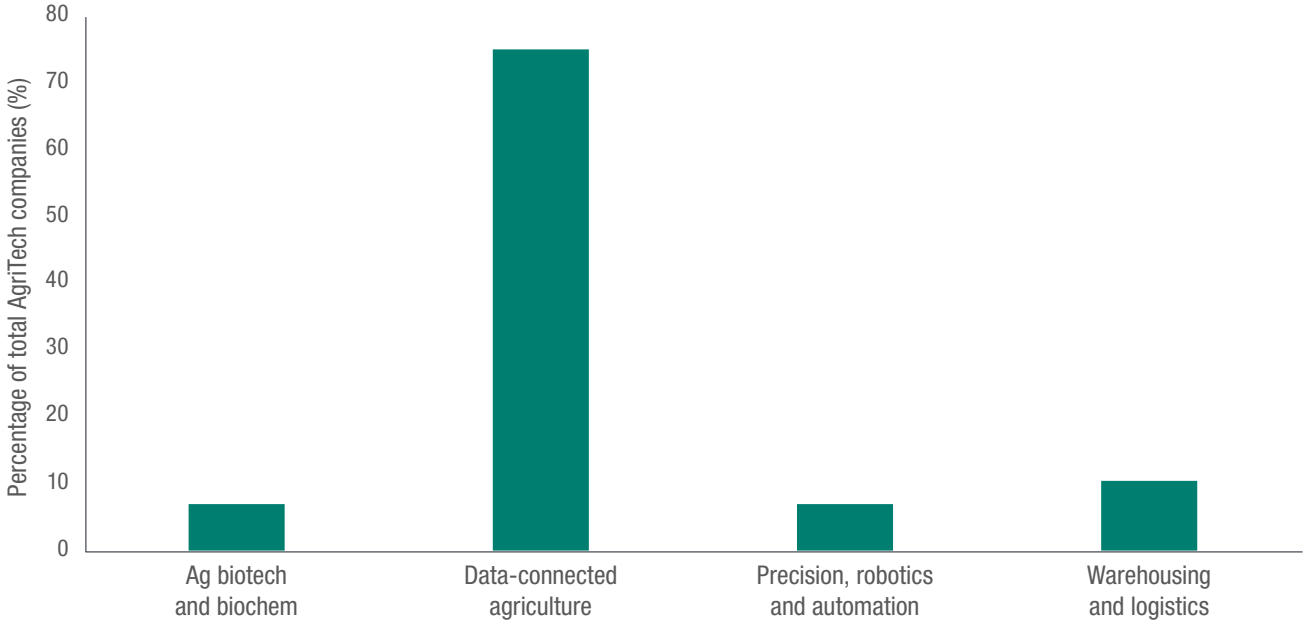
In this report, we study several under-researched questions that have, in the past, been addressed primarily through anecdotal evidence. This research is the first of its kind for Uganda, presenting empirical evidence on:

- the landscape of ag-platforms in Uganda
- the extent to which ag-platforms have facilitated or inhibited value capture through five channels:
  - productivity
  - market development (e.g. market access, diversification and value-addition)
  - formal work opportunities and income changes
  - women's empowerment
  - youth inclusion
- the impact of ag-platforms and other factors on the productivity of farmers.

The analysis in this study is based on survey data gathered from 821 farmers in Uganda in 2019, complemented by stakeholder insights through interviews with six government officials, 14 ag-platforms, five cooperatives, four buyers, three brokers, six donors, five input suppliers, three co-working space managers, and one mobile operator (see Annex 1).

Following this introduction, the report is structured as follows. Chapter 2 reviews existing literature (theoretical and empirical) to identify pathways of value capture of ag-platforms for each of the five channels. This is necessary because of the dearth of research in Uganda and because it allows for comparison of our results with other countries. Chapter 3 presents the data collection processes, sampling and mixed-method approach used in the study. Chapter 4 presents findings from the survey and interviews to illuminate the differences in functioning and 'value capture' of farmers in platformised versus traditional value chains, as well as econometric evidence on the impact of ag-platforms and other factors on the productivity of Ugandan farmers. Chapter 5 brings together the conclusions emerging from the research, together with policy implications.

**Figure 1 AgriTech categories in Uganda 2017–2018**




Note: *N* = 28

# 2 Research background: value creation opportunities of ag-platforms for trade and development

This chapter presents an overview of the new opportunities for value creation and capture created by participation in ag-platforms. We review theoretical and empirical literature around these opportunities, focusing primarily on countries in Africa and Asia, using the literature as a way to compare and contrast the findings from Chapter 4 on Uganda.

## 2.1 Ag-platforms: access to productivity-enhancing services

Agricultural productivity is defined as including technical efficiency in the use of inputs (e.g. fertilisers, chemicals, extension services), the days of labour used, and the costs of capital (e.g. land) and technological progress that enables that agricultural sector to produce more with less. This is also known as total-factor productivity or the residual extra value created by output that grows faster than the growth of all the combined inputs and factors that go into production (World Bank, 2017). Within agriculture, productivity can also be defined in terms of partial productivity if, for example, it focuses only on crop yields (the volume of crop produced over the total land area of the crop) or a change in the total costs of growing a crop (FAO, 2020). Partial productivity models are used whenever it is difficult to gauge information on labour and technological progress (Mason-D'Croz et al., 2019).

Studies have covered a range of issues around ag-productivity, such as land ownership and the hidden costs of labour masked by family labour. Our aim, however, is to focus on aspects related to digital platforms. With the proliferation of ICT usage, mobile phones are being used increasingly to deliver agricultural extension services.[1] For example, a randomised experiment for cotton in Gujarat, India by Cole and Fernando (2012) revealed a statistically significant increase in the use of mobile-based information for agricultural growing decisions (Cole and Fernando, 2012). They were able to show that farmers with access to mobile phones had an uptake of cotton fertilisers that was 22% higher, and of cotton pesticides that was 30% higher, than other farmers. These farmers also began to purchase more effective pesticides than those in the control group.

Another example, in Northern Ghana, found that farmers who participated in an ICT-based management information system project were more likely to use improved seed varieties than non-participants (Al-Hassan et al., 2013). In a

1 Agricultural extension is broadly defined as the transfer of technology, management techniques and agricultural knowledge from public or private institutions to rural people to support their sustainable agricultural production, transformation and marketing (Anderson, 2016).

similar vein, Kilimo Salama, a weather-based mobile-app in Kenya provides insurance for farmers' inputs (e.g., seeds, fertilisers, chemicals) and sends text messages on ways to improve farming techniques. Kilimo Salama users have reported an average increase in their incomes of $150 and a 50% increase in crop yields as a result of insurance for farm inputs in 2018 (Krishnan et al., 2020a). Focusing on small-holder sugar-cane farmers, PAD (2018) found that sending SMS messages with agricultural advice to farmers increased their yields by 11.5%. PAD also demonstrated greater efficiency in the delivery of inputs, as farmers could report delays in fertiliser delivery through the app.[2] In sum, these examples suggest that the use of mobile phones in extension services has resulted in productivity gains.

## 2.2 Ag-platforms: facilitating market access, value-addition and diversification

Ag-platforms offer new opportunities for access to better inputs and new markets, and facilitate trade and integration through reductions in production costs, and transaction and exchange costs, as well as a reduction in information asymmetries. In Niger, for example, mobile phones reduced the costs of production by facilitating a reduction in search costs, while simultaneously speeding up access to better information (Aker, 2010). Another example from Kerala, India, showed that the introduction of mobile phones in the fisheries led to a substantial reduction in the price spread (auction sale and buying price): the difference between maximum and minimum prices across markets was reduced by 5 Rs/kg on average (Jensen, 2007). In the same vein, the introduction of mobile phones increased fishermen's profits by 9% (ibid.).

Ag-platforms can create other opportunities linked to diversification of products, new markets or movement into new value-added functions. The study by Cole and Fernando (2012), for example, showed that farmers who used mobile phones in Gujarat, India diversified beyond cotton by increasing their cumin acreage to balance out lean seasons. Another example is the role of ag-platforms in functions downstream in the value chain, such as marketing, branding, greater sophistication, and improvements in quality through processing. For example, the use of the Fairtrade farming apps have enabled farmers to invest their social premiums in opportunities to add value at source (e.g. packaging) (Fairtrade Foundation, 2019). Twiga Foods in Kenya has helped to revolutionise the way small kiosks stock their inventories, while providing loans, helping to radically disrupt the norms, and change the behaviour and management style of many shop-owners across Kenya (Twiga, n.d).

## 2.3 Ag-platforms: formalisation of work and income opportunities

In terms of employment, Mbiti and Weil (2011) find that M-Pesa (mobile money) in Kenya increases employment by 12 percentage points. They suggest that the increased resource flows generated by M-Pesa are channelled towards farming, boosting the demand for labour and subsequently increasing employment.

In terms of income, initial estimates of the impact of SMS-delivered information on market prices, weather and crop advisory services in India show that farmers who subscribe to these services earn 5% to 10% more income. Meanwhile, Farmerline, a project that delivers agricultural information via voice messages directly to the mobile phones of female agricultural workers in Cameroon, Ghana, Nigeria and Sierra Leone, has increased farmers' yields by up to 55% and incomes by up to 44% (World Bank, 2017).

Qiang et al. (2012) have gathered quantitative estimates of the impact of m-apps on farmers'

2 Similar results in terms of efficiency gains were found in the livestock sector. In India, for example, an e-Learning project that combines credit and structured learning delivered through four to six voice messages on farmers' mobile phones led to improved sheep and goat management by participants compared to non-participants (Balasurbramian and Daniel, 2010). An assessment of the impact of the mobile application (m-app) 'E-dairy' in the Philippines reveals that more timely access to veterinary services led to a 30% increase in milk production and an additional income of $262 per calf (Qiang et al., 2012).

incomes. In Kenya, AgriManagr has generated additional income of around $300 (up by 9%) for small tea growers, mainly as a result of more accurate recording of production volumes. Farmers who use the DrumNet (pilot) have reported a 32% increase in income, as users have benefitted from supply-chain support, increased bank creditworthiness and reduced transaction costs. Kenya Agricultural Commodity Exchange (KACE), which has provided pricing information and supply chain services to farmers, has led to higher incomes for 75% of the farmers participating and 60% of the commodity traders. In Sri Lanka, Tradenet users that live 10–15 kilometres from the nearest markets have gained an average premium of 23% on the price per kilogram, as the m-app has enable them to plan optimal market entry times and minimise sunk costs (e.g. transport costs).

In contrast, some research suggests that mobile platforms are not beneficial for farmers in terms of receiving better prices for their products. Fafchamps and Minten (2012), for example, find no statistically significant effects of SMS-based agricultural information services in India on the prices received by farmers. However, the authors attributed the results, in part, to the small numbers of farmers using the service and subsequent stagnation in take-up during the study period. In Ethiopia, Tadesse and Bahiigwa (2015) find that household ownership of mobile phones has limited impact on the price level of teff, maize and barley (with wheat prices an exception). They suggest that this is because farmers may have not used the mobile phones for price discovery or found the mobile phone-delivered information irrelevant, and that the efficiency created by the use of mobile phones may have been appropriated primarily by local traders, rather than the farmers themselves. Both cases highlight the need to tailor agricultural information that is relevant and appropriate to the absorptive capacity of the recipients who are targeted.

Some evidence also suggests that the impact of mobile phones on improving agricultural prices may be limited by the dynamics of the relationships between producers and traders. Specifically, Al-Hassan et al. (2013) suggest that farmers in Northern Ghana who transact in distant markets rely on established and trusted trading partners and have less need for management information systems (MIS). The empirical results suggest that a unit increase in the distance to a local market in Northern Ghana reduces the chances of participating in ICT-based MIS by 7%. The authors report that if farmers do not know anyone they can trust at the farm gate or distant markets, trader arbitrage will prevent them obtaining a better price by selling elsewhere.

There are also implications for consumption: the findings of Labonne and Chase (2009) indicate that mobile-phone purchases have a significant and positive impact on the household-level growth rate of per capita consumption (11% to 17%) of farmers in rural areas of the Philippines. In Northern Ghana, participation in ICT-based MIS was seen to have increased farmers' expenditure not only on pesticides, but also on consumption (measured by households being able to meet the recommended daily calorie intake) (Al-Hassan et al., 2013).

## 2.4 Youth inclusion

Data suggest that African countries need to create about 12–15 million jobs to absorb the youth who enter the job market each year (AfDB, 2019). One key value creation opportunity is, therefore, the addition of more youth into the labour force.

Ag-platforms can boost youth inclusion in two ways. First, as developers of ag-platforms through the use of their digital (ICT skills) and soft skills, such as their skills as entrepreneurs. Banga and te Velde (2018) highlight three categories of skills that are emerging as critical in the digital age: 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; and soft skills such as communication, management and critical thinking.[3]

3 The provision of digital and soft skills requires supply-side policies on formal education, formal and informal technical and vocational education and training (TVET), and employer-led training and demand-side policies to foster innovation, competition and skill-upgrading, as well as coordination mechanisms such as online portals to match the supply and demand of skills.

Youth are now being encouraged to return to agriculture as 'smart farmers' and use digital technology and digital innovations in farming practices. The youth-led Akorian app, for example, focuses on digitising the agriculture value chain and enabling smallholder farmers in Uganda and other agriculture service providers to access information and high-quality production and marketing services through EzyAgric. EzyAgric has over 60,000 registered farmers and has created over 480 jobs for youth in agriculture and ICT development (Krishnan et al., 2020a). Most of the ICT innovators in Uganda are aged between 19 and 29, with those aged 24–27 the most active age group in this area (ibid.).

## 2.5 Gender inclusion

In terms of gender, ag-platforms have the potential to reduce the gender gap in terms of 'access' by improving access to digital skills, finance/credit and work opportunities, reducing information asymmetries and training gaps, and supporting the creation of a level playing field for women. Another benefit that has been claimed for ag-platforms is that they increase efficiency by matching demand to supply. There has also been advocacy for use of ag-platforms to empower women by improving their bargaining rights, increasing their incomes and reducing the likelihood of gender violence on farms through reporting mechanisms (Tsan et al., 2019).

Boosting gender inclusion, however, requires the narrowing of a persistent gendered digital divide, in terms of basic access to the internet and basic ICT skills. Such a persistent divide can further exacerbate gender inequality, where women are less likely to have access to mobile phones (Mumporeze and Prieler, 2017). In Malawi, Katengeza et al. (2011) find that female farmers with fewer resources are far less likely to use mobile phones for agricultural marketing than their male counterparts. In South Western Uganda, women are also less likely to use mobile phones than men, but when they do, female farmers are more likely to request information on natural resource management and agriculture than male farmers (Masuki et al., 2010).

More broadly, ag-platforms are seen as a route to empowerment (Tsan et al., 2019). Where producers can access better and timely information from mobile phones, they can negotiate for higher farm-gate prices. This has been evident in the Philippines, where ownership of mobile phones enables rural farmers to strike better price deals within existing trading relationships and make better choices about markets where they can sell their goods (Labonne and Chase, 2009).

Overall, this section has summarised the channels through which ag-platforms create new value capture opportunities for farmers. However, Krishnan et al. (2020b) caution that while ag-platforms offer multiple sources of value creation, several challenges emerge. As they point out in their paper on ag-disruptors in East Africa, ag-platformisation through the 3Cs – costs, complexity and capabilities – may exacerbate or reproduce existing inequalities rather than supporting value creation.

The high costs of running a platform, for example, could push the costs on to farmers who are unable to pay for services. These could be considered costs that cannot be recovered, as they are necessary to upgrade existing processes of doing business. In addition, costs are incurred when paying for commissions on inputs and other services available to farmers on the app suite. These extra costs may, therefore, inflate the price paid by farmers for both inputs (e.g. specific chemicals) and services (e.g. information, using services). In some cases, high costs may compound gender divides by reducing women's ability to access or afford new technologies (Krishnan et al., 2020b).

Another challenge is the complexity and related capabilities of adopting ag-platforms. Complexity occurs where ag-platforms have a high technological intensity, and can leave farmers with lower capabilities at a disadvantage. If they lack the digital skills to use new technology or are unable to merge old and new technologies for production, harvesting, quality control, operation and maintenance and monitoring of productivity, they may face significant barriers to their uptake and use of ag-platforms. This reduces their competitiveness and marginalises them still further from participation in value chains (Krishnan et al., 2020a).

# 3 Data collection and sampling strategy

In this chapter, we describe the process through which data were collected, and the details of the novel sampling process employed to ensure that the data were robust and representative. We begin by explaining how the ag-platform value chain was mapped, how actors were identified, and how the multi-stage sampling strategy was pursued.

## 3.1 Value-chain mapping and the identification of actors for data collection

Value-chain mapping is defined as a process that determines the input–output structure of each 'node' and the different value-chain actors involved (Fernandez-Stark and Gereffi, 2019). We considered the following to map an ag-platform value chain:

- What are the main nodes of the traditional versus ag-platform value chain?
- Who are the main actors, and what are their functions in the traditional versus ag-platform value chain?

A node is the stage of the value chain where the value of a product is created and can be classified as being upstream in the value chain, midstream or downstream. Upstream nodes include the input and production stage. The input stage involves pre-production activities, such as sourcing seeds, chemicals, fertilisers and agricultural machinery, as well as labour and finance. The production node involves the process of growing a crop, extension support and the sale of crops to intermediaries (apps, brokers and agents, for example) and the processing of the product. Midstream nodes involve logistics related to the intermediary product, including warehousing and the cool chain. Downstream nodes are retail/sale either business-to-business (B2B) or business-to-customer (B2C) (Reardon et al., 2019). Retail consumers can be local people, supermarkets, other processors, wholesalers or restaurants.

We mapped vertical and horizontal actors and their main activities, differentiating between the actors serving the ag-platform and those serving a more traditional value chain (see Annex 2 for information on a traditional value chain). Vertical actors are those involved in different commercial activities of the value chain, from production to retail, while horizontal actors are those not directly involved in production activities but who play an important role in facilitating the functioning of the value chain (Stein and Barron, 2017). Many of these actors may overlap, as they participate in both ag-platform and traditional value chains. Table 1 sets out the main types of vertical and horizontal ag-platform value-chain actor.

## 3.2 Data collection and sampling strategy

Data were collected in two phases. Phase 1, the interview stage, took place in April 2019. We performed semi-structured interviews with more than 35 vertical and horizontal actors in the ag-platform value chain to map out a landscape of the models prevalent in Uganda (see Annex 1 for the list of stakeholders interviewed). The 47 individual respondents included government officials, ag-platforms, cooperatives, buyers, brokers, donors, input suppliers, co-working space managers and mobile operators. These interviews fed into Phase 2: the survey design, sampling and dissemination stage that took place between July and November 2019. The survey was rolled out to more than 800 Ugandan farmers.

**Table 1 Vertical and horizontal actors in the ag-platform value chain**

| Node | Ag-platform vertical actor | Actor specifics | Traditional vertical actor |
|---|---|---|---|
| **Upstream** | Input suppliers | Seeds/saplings<br>Ag-chemicals firms<br>Machine suppliers<br>Financial services/Savings and Credit Cooperative Societies (SACCOs) | Seeds/saplings<br>Ag-chemicals<br>Machine suppliers<br>Financial services/SACCOs |
| | Production | Platform extension officers<br>Village champions*<br>Product aggregators | Brokers/intermediaries<br>Govt. extension officers |
| **Midstream** | Processing | Processors | Processors |
| | Logistics | Logistic providers<br>Ag-platforms firms | Logistics providers |
| **Downstream** | Retail (B2B) | Ag-platforms firms<br>Buyers | Buyers |
| | B2C | Buyers | Buyers |

* Youth leaders in villages who are trained in using the app.

The process of sampling farmers who use ag-platforms is complex because ag-platform firms are not necessarily registered with the Uganda Revenue authority, and because they do not share their farmer database in the public domain as a result of data privacy restrictions. It is almost impossible, therefore, to obtain a roster of ag-platform firms or lists of farmers who have used an ag-platform app.

One way to overcome this challenge is to use census-based methods, creating a complete universe of farmers across the country and asking them whether they have used an app or not. This type of sampling would enable perfect coverage of the population, but is very time-consuming and expensive. To mitigate the lack of data, we developed a robust three-step sampling methodology that can be generalised across farmers.

The first step aimed to create a sampling 'universe' of farmers participating in ag-platforms. Through the interviews conducted, multiple lists of farmers were collected from ag-platform firms, government officials (ICT officers) and cooperatives (e.g. Uganda Cooperative Alliance – the largest cooperative in Uganda). Each of the lists provided details such as the farmer's name, land size and crops grown. For ethical reasons, the specifics of farmers' national IDs and banking information were not collected. Not all of the 14 app firms were willing to participate in the survey, and some were only starting operations in 2019. Only those ag-platforms that had been operating for at least a year and were still operating at the time of the survey were eligible to take part. Thus, a total of four platforms were selected, together comprising a total of 82,500 farmers from which we could draw our sample. The four platforms were:[4]

- E-Voucher
- MUIIS
- KOPGT
- EzyAgric.

4 Because ag-platforms have only been rolled out in Uganda over the past five years, the number of farmers participating on these platforms is relatively low. Therefore, to produce reliable estimates for a relatively rare (very small) sub-population of farmers (platform users), we oversampled ag-platform farmers (Kalton and Anderson, 1986). This helped to provide an adequate sample size that can be used to compare to traditional value-chain farmers. The sampling strategy is complex, as the total universe of platform farmers is unknown. Using multiple frames, alongside a multi-stage sampling strategy, ensures that the results are robust (Kalton, 2020).

The second step, once the list of farmers had been created, was to de-duplicate farmers who appeared more than once, as they may have moved between platforms. This de-duplication involved matching against a farmer's name, and any other information available in the list (such as land size or address). Such de-duplication was carried out before sample selection, i.e. at the design stage (Gonzáles Villalobos and Wallace, 1998).

Once de-duplication was completed, a multi-stage sampling methodology was followed, where the de-duplicated lists were stratified (third step). This was done on the basis of largest farmer density (numbers and/or production). Density of farmers was calculated by finding clusters in a specific area. Figures 2, 3 and 4 show the total share of farmers in each district by app, according to the universe of data collected.

The key areas selected through the sampling were the districts of Lira, Kalangana, Mubende, Masaka and Kyotera, which had the highest share of farmers for each app (see Table 2 for a summary of the key districts by app). For traditional farmers, we gathered lists of names from cooperatives and village leaders, combined with snowball sampling, in the same selected regions. Sampling from proximate regions ensured that traditional farmers grew crops with similar natural resources and similar demographic indicators. Once the stratification of farmers was complete, we performed a random sampling for ag-platform and traditional farmers. The sample size was calculated using Cronbach's formula to ensure that it was adequate.[5]

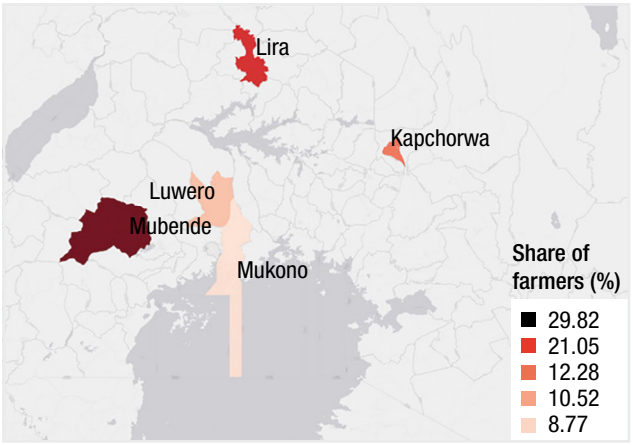
**Table 2 Stratification of sample for ag-platform farmers**

| Name of app | District 1 | District 2 |
|---|---|---|
| E-Voucher | Kyotera | Masaka |
| MUIIS | Mubende | – |
| KOPGT | Kalangana | Masaka |
| EzyAgric | Lira | – |

**Figure 2 Share of farmers enrolled in E-Voucher**

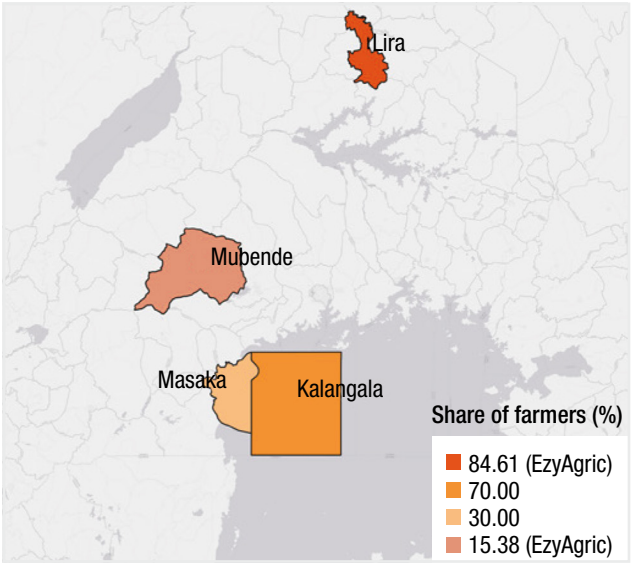

Source: Uganda ag-platform survey, 2019

**Figure 3 Share of farmers enrolled in MUIIS**




Source: Uganda ag-platform survey, 2019

**Figure 4 Share of farmers enrolled in EzyAgric and KOPGT**




Source: Uganda ag-platform survey, 2019

5 Cronbach's formula dictates that to determine the sample size, the researcher needs to know three things: the population of producers in a given cluster, the acceptable confidence level and the margin of error.

In order to comprehend ag-platform business models, we also classified the apps under five types following the typology set out by Krishnan et al. (2020a). This typology is based on the combination of various scopes (breadth of functions and processes) and scales (destination of final product), identifying five distinct types of models as follows.

- **Production and exchange** model, consisting of backward exchange, horizontal offers and information services, where farmers gain production-related information along with artificial intelligence and support for big data analytics. They tend to occur at the pre-production and production stage of the value chain. These are normally local and regional value chains.
- **Output exchange** occurs at the midstream point in the value chain and consists of three scopes: forward exchange, post-harvest and information services. This is an auction-based model (i.e. crop auction through online bidding), with farmers receiving information on crop prices and logistic prices to transport products; as well as post-harvest services such as grading and packaging. These are, primarily, sold locally.
- **Trading and sharing** consists of six 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 right through to the output sale. These products are often sold globally, but sometimes locally.
- **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, as well as a guarantee of purchase at specific market-defined prices. These products are sold both locally and regionally.
- **Integrated single-buyer** consists of a completely vertically integrated value chain where the main offtaker/buyer (whether a processor or retailer) controls the entire value chain directly and where there is already a pre-determined market. These products can be sold globally, regionally or locally.

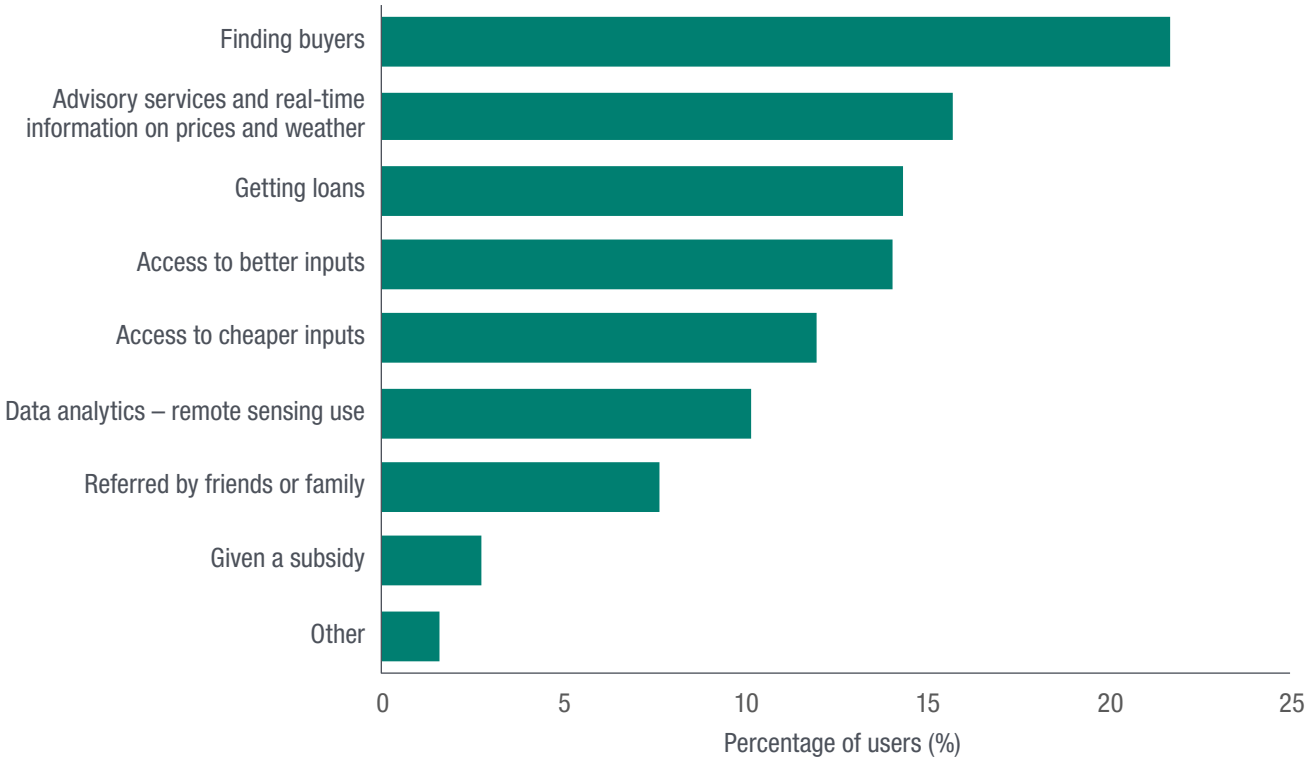
# 4 Ag-platforms: evidence from Uganda

## 4.1 Landscape of ag-platforms in Uganda

This section presents an overview of ag-platforms in Uganda. A total of 821 farmers were sampled, of whom 52.74% (433 farmers) were registered on an ag-platform and 47.26% (388 farmers) were part of a traditional value chain. In all, 48% of the farmers were classified as youth and 57% as male. About 46% of the users pay to use the ag-platforms (many platforms provide subsidies and, therefore, do not require payments), while 24% of users pay to use in-app services. It is important to note, however, that overall registration does not necessarily translate into frequent users: these account for 20–50% of those surveyed. This matters because several apps have ceased to operate as a result of low usage by farmers.

Farmers who use ag-platforms report that their main reasons for registering relate to sale of produce; over 20% of users ranked 'finding buyers' as the most important reason for registering (Figure 5), followed by access to advisory/extension services, information on prices and weather (15.7%); obtaining working capital or loans (14.3%), and gaining access to better inputs (14%).

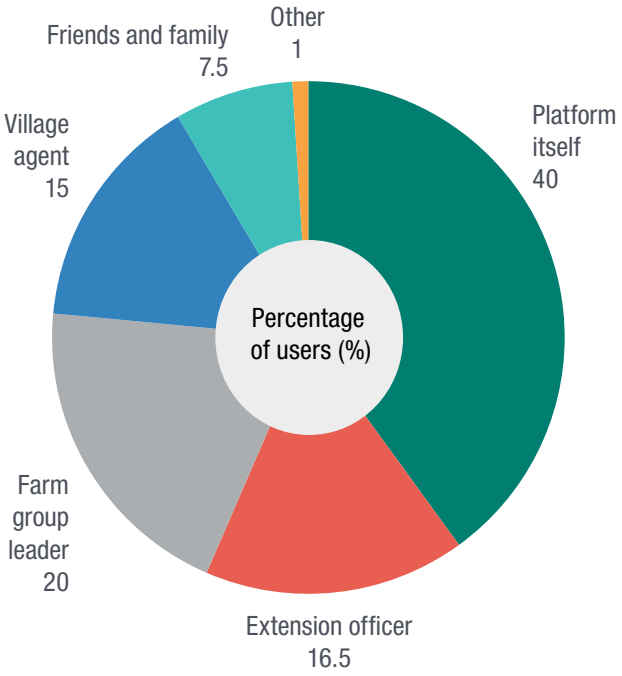
**Figure 5 Top reasons for registering on ag-platforms**




Source: Uganda ag-platform survey, 2019

In terms of support for using the Ag-platform itself, Figure 6 shows that 40% of farmers are receiving support from the ag-platform itself; and 20% are receiving it from the leaders of a farmers' group or from a cooperative of which they are a member. Cooperatives are seen as a key mechanism for the organisation and management of farmers in Uganda (GSMA, 2017), with the Uganda Cooperative Alliance (UCA) being the country's main cooperative management body.

**Figure 6 Support in using ag-platforms**




Source: Uganda ag-platform survey data, 2019

About 16.5% of support to use ag-platforms comes from extension officers. These officers are often hired by the platform directly, or are employees of sub-national governments. The remaining support is comprised of 15% provided by village agents (who are village leaders or village youth champions, who work with the platform on a commission basis); and approximately 8.5% that comes from family, friends and others. Among female users, 31% rank the ag-platforms themselves as the primary source of support, followed by farm group leaders (26%) and village agents (17.75%). It is important to note that 28 respondents who reported being users of ag-platforms but who do not own a mobile tend to use the platform with the help of the village agent. In such cases, the agents relay information to the farmers, using the app on their personal device.

In terms of the use of ag-platforms for primary crops (see Table 3), we find that almost 40% of the 433 platform users use the platforms for maize, followed by coffee (21%), soyabean (15.47%), cassava (6.24%) and palm (6%). Most of these crops are also primary crops for non-platform users (or traditional value chain farmers). This suggests that most farmers are growing either cereals (which are considered to be relatively low-value crops) or high-value crops such as plantation or oilseeds.

The value chain for coffee provides an interesting case. Coffee remains a leading agricultural commodity for Uganda and significant efforts have been made to digitalise its value chain. For example, Uganda's National

**Table 3 Primary crops grown by non-ag-platform users and ag-platform users**

| Non-ag-platform users | | | Ag-platform users | | |
|---|---|---|---|---|---|
| Crop | Number of farmers | Share of total (%) | Crop | Number of farmers | Share of total (%) |
| Maize | 179 | 47.73 | Maize | 170 | 39.26 |
| Cassava | 47 | 12.53 | Coffee | 91 | 21.02 |
| Soyabean | 36 | 9.60 | Soyabean | 67 | 15.47 |
| Bean | 27 | 7.20 | Cassava | 27 | 6.24 |
| Coffee | 23 | 6.13 | Palm | 26 | 6.00 |
| Other | 63 | 16.80 | Other | 52 | 12.01 |

Note: Primary crop of ag-platform users is the main crop for which the platform is used. Primary crops may differ for platform and non-platform users.
Source: Uganda ag-platform survey data, 2019

Union of Coffee Agribusinesses and Farm Enterprises (NUCAFE), Technical Centre for Agricultural and Rural Cooperation (CTA) and the Pan African Farmers Organisation have partnered in the Data4Ag project to improve the data management systems and financial skills of NUCAFE and its hub members to strengthen the development of the coffee value chain. NUCAFE has generated farmer profiles and maps of coffee farms and the digital profiling of farmers has enabled the traceability of coffee back to its growers. This is paying off for NUCAFE's 210 coffee farmers and farmer organisations – totalling 205,120 farming families (Tsan et al., 2019).

Classifying apps across the business model typology (as described in Chapter 3), we find that E-Voucher and MUIIS are both production and exchange business models, while KOPGT is single-buyer related and EzyAgric is a trading and sharing model. We could not identify any guaranteed purchase and logistic business models in Uganda.

Table 4 shows that most of the farmers using an ag-platform use E-Voucher, followed by MUIIS. Of the 433 users, 241 respondents are men (55.65% of the sample) and 192 are women, with the highest number of women using E-Voucher, followed by KOPGT. Both apps have government oversight, and aim to create distribution that is gender equitable. The remaining apps are driven by micro enterprises.

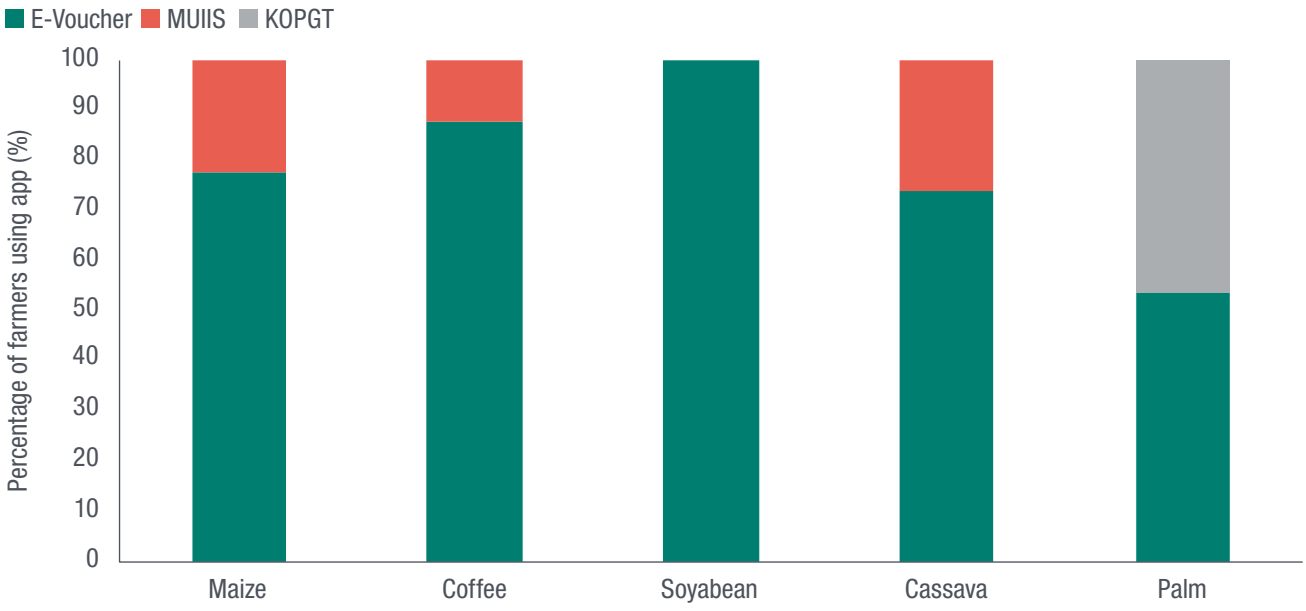
Figure 7 shows primary crops by type of Ag-platform. Of the 170 farmers using platforms

**Table 4 Platform users sampled, by type of app**

| Ag-platform | Type of ag-platform model | Number of farmers | Distribution of farmers (% share) | Female users (% of total) |
|---|---|---|---|---|
| E-Voucher | Production and exchange | 212 | 48.96 | 50% |
| MUIIS | Production and exchange | 56 | 12.93 | 27% |
| KOPGT | Integrated single-buyer | 7 | 1.61 | 43% |
| EzyAgric | Trading and sharing | 49 | 11.31 | 37% |
| Other | Not classified due to lack of information | 109 | 25.17 | – |

Note: *N* = 433. Yield = output of crop (tons)/crop area (acres).
Source: Uganda ag-platform survey data, 2019

**Figure 7 Use of platforms, by crop**




Source Uganda ag-platform survey data, 2019

who rank maize as their top crop, 46% use E-Voucher, followed by 13.5% who use MUIIS and 13.5% who use EzyAgric. For the 91 platform-user farmers who rank coffee as their top crop, over 50% are using E-Voucher.

## 4.2 Ag-platforms: value capture opportunities in Uganda

### 4.2.1 Access to services that enhance productivity

Ag-platforms users in Uganda have higher access to productivity-enhancing services than non-platform users, as shown in Table 5. Over 70% of platform users have access to agricultural training on planting, fertiliser use, post-harvest maintenance and health and safety, compared to less than 45% of non-platform users. Similarly, a larger proportion of ag-platform users have access to real-time information on market prices, weather updates and pest control than farmers who do not have access to an ag-platform.

The share of farmers who have access to crop insurance services is low for both ag-platform users and non-users, at 6% and 3% respectively.

In terms of access to input services across ag-platform models, the results indicate that training (on, for example, good agricultural practices or the use of chemical fertilisers) is received by over 60% of farmers across all models (see Table A1 in Annex 3).

As shown in Table 6, the share of ag-platform users who have access to capital and commercial loans is also higher than for non-users, by almost 20 percentage points, with almost half of the farmers from both groups using mobile wallet for production purposes. This suggests that there is little difference in the shares using mobile wallet, and that insurance access is low in both groups.

With better information on real-time prices through the ag-platforms, we expect that farmers are able to plan the best time to sell to the market or to other buyers when their harvests are large, reducing the amount of unsold produce.

**Table 5 Access to agricultural training and real-time information**

| | | Ag-platform users | | Non-users | |
|---|---|---|---|---|---|
| | | Number of users | Share of total users (%) | Number of non-users | Share of total non-users (%) |
| Access to agricultural training | Good agricultural practices on planting | 327 | 75.52 | 174 | 44.9 |
| | Chemical and fertiliser use | 312 | 72.06 | 72 | 44.3 |
| | Good practices on post-harvest maintenance | 307 | 70.90 | 147 | 37.9 |
| | Health and safety | 319 | 73.67 | 169 | 43.6 |
| Access to real-time information | Market crop prices | 326 | 75.29 | 231 | 59.5 |
| | Weather updates | 244 | 56.35 | 175 | 45.1 |
| | Pest control or disease related updates | 302 | 69.75 | 184 | 47.4 |

Source: Uganda ag-platform survey, 2019

**Table 6 Access to financial services**

| | | Number of users | Share of total users (%) | Number of non-users | Share of total non-users (%) |
|---|---|---|---|---|---|
| Access and/or financial services | Capital or commercial loans (access) | 223 | 51.50 | 125 | 32.2 |
| | Crop insurance (access) | 25 | 5.77 | 11 | 2.8 |
| | Mobile money or wallet for production purposes | 256 | 59.12 | 220 | 56.70 |

Note: $N = 821$
Source: Uganda ag-platform survey, 2019

The rate of rejection of produce by buyers and the losses incurred because of lack of storage facilities are long-standing challenges that not only limit the capacity of farmers to optimise sale of their product, but also reduce trust in buyers. Research by Okello et al. (2007) and Krishnan (2018), for example, show over 15% of the produce in Kenya's horticulture chains is lost as a result of poor warehousing facilities or is rejected by the buyers because of bite marks or discoloration on products, causing serious problems around trust and transparency.

In the Ugandan case study, the data suggest that the share of ag-platform users who reported losses caused by lack of storage is lower (by roughly 9 percentage points) than for non-platform users (see Table 7). The average percentage of output losses caused by lack of storage is also significantly higher (by 4.35 percentage points) for non-platform users than for platform users. However, more ag-platform users reported incidence of their produce being rejected, with the share of these rejected products to total output higher among users (24%) than non-platform users (20%). This suggests that platformised farmers are selling to buyers who have higher standards and reject more produce.

There are stark differences in the number of farmers who reported rejected produce across the types of ag-platform models, as shown in Table A1 in Annex 3. The single-buyer model demands higher quality than other models because it is vertically integrated and the knowledge on best practices is shared directly by buyers. The benchmark against which products are judged for quality, therefore, is more stringent than in other models of ag-platforms. About 43% of farmers participating in the single-buyer model reported rejection, compared to only 12% in production and exchange, and 16% in trading and sharing. This suggests that despite vertical integration in single-buyer models, rejection may be more likely.

The overall sample of 821 farmers does not reveal any significant productivity differential between platform users and non-users (perhaps because of the inclusion of crops of varying yields). Table 8, however, looks more closely at the case of maize and conducts t-tests to check for productivity differential across platform use. It finds that for the sub-sample of farmers who rank maize as their top crop, platform users have significantly higher yields, on average, than non-platformised maize farmers. When we compare crop productivity of maize across types of ag-platform models, we find that maize yield is, on average, highest for trading and sharing platforms at 0.810 tons/acre, followed by production and exchange at 0.698 tons/acre. Both of these values are higher than the yield

**Table 7 Output losses caused by lack of storage and rejection of produce**

| | Lack of storage | | Rejected produce | |
|---|---|---|---|---|
| | Number of farmers that reported losses | Average % of output losses | Number of farmers that reported losses | Average % of total output sold |
| Users ($N = 443$) | 175 | 13.55** | 46 | 23.54 |
| Share of total users (%) | 40.42 | – | 10.62 | – |
| Non-users ($N = 388$) | 193 | 17.90 | 40 | 20.25 |
| Share of total non-users (%) | 49.74 | – | 10.31 | – |

**Table 8 Yield differential for maize farmers, by platform use**

| | | Number of farmers | Mean | Standard error |
|---|---|---|---|---|
| Productivity (tons/acre) | Non-platform users | 179 | 0.603 | 0.035 |
| | Platform users | 170 | 0.723** | 0.040 |

** Significant at 5%.

achieved by non-platform users, which stands at 0.601 tons/acre (see Figure A2 in Annex 3).

### 4.2.2 Facilitating market access, diversification and value addition

As shown in Figure 5, one of the main reasons given by farmers for registering on an ag-platform was the hope of easier access to buyers. Data from the survey show that of the 821 farmers, 33% of those who use ag-platforms reported they have faced difficulty in finding a buyer (Table 9) compared to 36% of non-users. These absolute values are not far apart, suggesting that both users and non-users face challenges that have yet to be alleviated through platforms. Both users and non-users claimed that the high costs of transport to move produce from their farms to the crop aggregation centre/collection point posed the biggest difficulty when trying to find a buyer. About 11.27% of non-users reported a lack of knowledge on how to find buyers, compared with 7.5% of users. In sum, it is critical for ag-platforms to focus on logistics, and to reduce transaction costs and provide differentiated value to traditional value chains.

There were also differences in finding buyers across the models of ag-platforms (see Table A2 in Annex 3). Almost 60% of the farmers using a single buyer-led model reported that they could sell produce to off-takers relatively easily, while only 34% of production and exchange model farmers claimed it was easy to find buyers.

Table 10 examines diversification of farmers across ag-platform use in terms of their movement into new products, new markets or new functions. Overall, it shows that 30.33% of the 821 farmers surveyed have diversified, with 54.22% expanding into new products and 22% into new markets. On comparing those that have diversified, 23.44% of platform users have done so into new markets, compared to only 19% of non-users. However, only 50% of users have diversified into new products, compared to 58.68% of non-users. The results in Uganda suggest that, contrary to the suggestions emerging from studies like that of Cole and Fernando (2012) that mobile-phone use facilitates new product diversification, participation on an ag-platform may enhance access to multiple new markets but does not promote diversification into new products.

As shown in Table 10, less than 3% of the total sample have adopted greater value addition as a form of diversification. Among those ag-platform users and non-users who diversified, less than 10% have diversified by going beyond their existing value-addition activities.

We examine this further by looking at the type of value addition used by farmers (see

**Table 9 Difficulties in finding a buyer**

| | Total observation | Farmers that reported difficulties in finding a buyer | Main reasons for difficulty | | | |
|---|---|---|---|---|---|---|
| | | | Transport costs | Quality concerns | Don't know how to find them | Other |
| **Users** | **433** | **132** | **76** | **17** | **10** | **29** |
| Share of total users (%) | – | 33.03 | 17.55 | 3.93 | 2.31 | 6.70 |
| Share of total users who find it difficult to find a buyer (%) | – | – | 57.58 | 12.88 | 7.58 | 21.97 |
| **Non-users** | **388** | **142** | **80** | **15** | **16** | **31** |
| Share of total non-users (%) | – | 36.34 | 20.62 | 3.87 | 4.12 | 7.99 |
| Share of total non-users that find it difficult to find a buyer (%) | – | – | 56.34 | 10.56 | 11.27 | 21.83 |
| **Total** | **821** | **274** | **156** | **32** | **26** | **60** |
| Share of total sample (%) | – | 33.37 | 19.00 | 3.90 | 3.17 | 7.31 |
| Share of total farmers that find it difficult to find a buyer (%) | – | – | 56.93 | 11.68 | 9.49 | 21.90 |

**Table 10 Diversification across users and non-users**

| | Total observations | Farmers that diversified | Type of diversification | | | |
|---|---|---|---|---|---|---|
| | | | New product | New market | More value addition | Other |
| **Users** | **433** | **128** | **64** | **30** | **10** | **24** |
| Share of total users (%) | – | 29.56 | 14.78 | 6.93 | 2.31 | 5.54 |
| Share of total users that diversified (%) | – | – | 50.00 | 23.44 | 7.81 | 18.75 |
| **Non-users** | **388** | **121** | **71** | **23** | **11** | **16** |
| Share of total non-users (%) | – | 31.19 | 18.30 | 5.93 | 2.84 | 4.12 |
| Share of total non-users that diversified (%) | – | – | 58.68 | 19.01 | 9.09 | 13.22 |
| **Total** | **821** | **249** | **135** | **53** | **21** | **40** |
| Share of total sample (%) | – | 30.33 | 16.44 | 6.46 | 2.56 | 4.87 |
| Share of total farmers that diversified (%) | – | – | 54.22 | 21.29 | 8.43 | 16.06 |

**Table 11 Type of value addition across users and non-users**

| | Total observations | Farmers that are doing value addition | Type of value addition (main crop) | | |
|---|---|---|---|---|---|
| | | | Processing | Packaging | Other |
| **Users** | **433** | **143** | **58** | **43** | **42** |
| Share of total users (%) | – | 33.03 | 13.39 | 9.93 | 9.70 |
| Share of total users that do value addition (%) | – | – | 40.56 | 30.07 | 29.37 |
| **Non-users** | **388** | **141** | **70** | **37** | **34** |
| Share of total non-users (%) | – | 36.34 | 18.04 | 9.54 | 8.76 |
| Share of total non-users that do value addition (%) | – | – | 49.65 | 26.24 | 24.11 |
| **Total** | **821** | **284** | **128** | **80** | **76** |
| Share of total sample (%) | | 34.59 | 15.59 | 9.74 | 9.26 |
| Share of total farmers that do value addition (%) | – | – | 45.07 | 28.17 | 26.76 |

Table 11). Of the farmers who are doing value addition for their primary crop, at least 40% of ag-platform users and non-users are engaged in further processing (cleaning, sorting), followed by around 30% from both groups who package their own crops. The higher share of farmers (regardless of their access to platforms) involved in processing may have been influenced by their main crop, particularly maize, which requires more processing (cleaning, sorting) than any other type of value addition. Meanwhile, the larger share of ag-platform users engaged in packaging relative to non-users may reflect the higher number of ag-platform farmers who reported coffee as their main crop (following maize), as coffee may involve more packaging. In contrast, farmers who do not use ag-platforms report cassava and soyabean as their main crop (following maize), which may involve less packaging than required for coffee (see Table 3 on the primary crops).

In terms of the potential for value creation across types of ag-platforms, the results in Table A2 in Annex 3 demonstrate that farmers using the production and exchange model are the most diversified, while those using the single buyer-led model sell only to a specific buyer. When it comes to performing value addition, however, the results are similar, as they are for processing, with about 16% of farmers who use

the trading and sharing model performing value addition, compared to 14% of those using single buyer-led models.

### 4.2.3 Formalisation of work and income opportunities

Overall, the survey data show that about 65% of the farmers sampled have been earning more than 370,000 USH over the last three cropping seasons, which corresponds to more than $100 per year. Table 12 shows that a higher share of non-platform users reports household head (HH) income in the range of 100–60,000 USH and between 60,001–120,000 USH. Once the 120,000 USH threshold is exceeded, the share of users reporting HH income is higher than for non-users. A total of 547 farmers report income above 370,000 USH and most of them (55%) use ag-platforms.

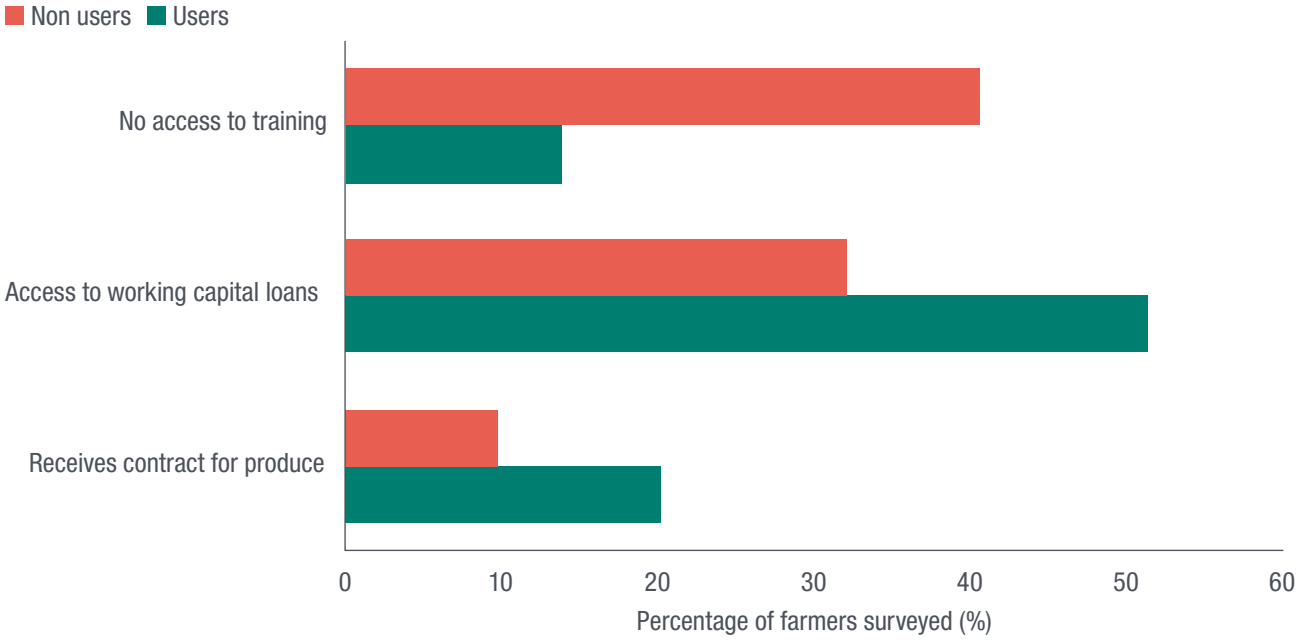
We find that 82.5% of platform users report that their expenditure on non-production purposes has increased over the past year, with only 9.4% reporting a decline and 8% reporting no change in their spending. In comparison, 75.5% of non-platform users report an increase, with 14.18% reporting a decline and 10.3% reporting no change. Of the 357 ag-platform users who report an increase, 44.8% report a change in the type of food purchased, followed by 35.2% who report an increase in the assets purchased. In contrast, 42.6% of the 293 non-users report an increase in spending on non-production purposes, followed by 31% reporting greater expenditure on their children's education.

Ag-platform users also appear to fare better in terms of formalisation of work, with 20% of users receiving a contract for their work, compared to less than 10% of non-platform users (Figure 8).

**Table 12 Agricultural household head income, by platform use**

| HH income range (USH) | Share of non-users | Share of users | Total number of farmers |
|---|---|---|---|
| 100–60,000 | 58.97 | 41.02 | 78 |
| 60,001–120,000 | 64.28 | 35.71 | 56 |
| 120,001–240,000 | 44.28 | 55.71 | 70 |
| 240,001–370,000 | 41.42 | 58.57 | 70 |
| >370,000 | 44.97 | 55.02 | 547 |

**Figure 8 Formalisation of work, by platform use**




Source: Uganda ag-platform survey, 2019

Similarly, 51% of platform users have access to working capital loans, compared to 32% of non-platform users. Among non-users, 40% of farmers have no access to training, falling to 13.8% for platform users. In terms of models of ag-platforms, integrated single-buyer models seem to have the highest access to working capital, followed by production and exchange and then trading and sharing models (see Table A3 in Annex 3). Only 22% of farmers under the production and exchange model report receiving a contract for produce, as compared to 85% who use integrated single-buyer models.

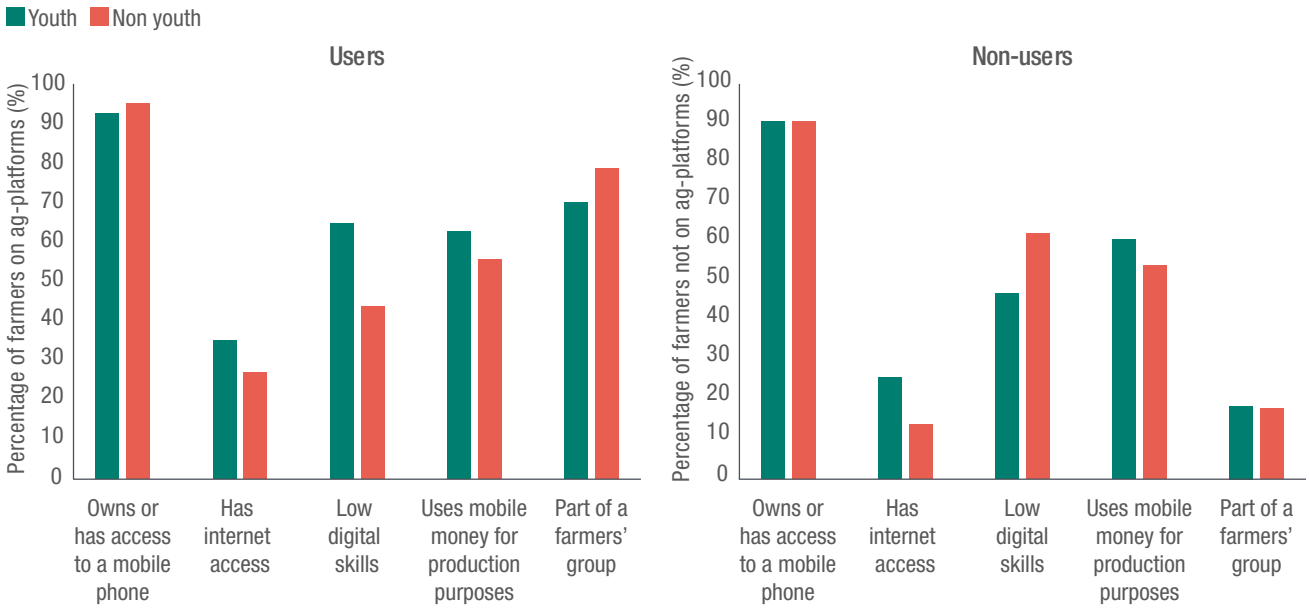
### 4.2.4 Youth inclusion

Empirical studies show that the benefits of ag-platforms may be greater for younger farmers and those with higher levels of assets and education. In Ethiopia, for example, farmers who are younger, better educated and those who have more livestock are more likely to own mobile phones than those who are older, less educated and who have fewer livestock (Tadesse and Bahiigwa, 2015). In Malawi, smallholder farmers with more access to land, physical assets and income are more likely to use mobile phone technology for agricultural marketing (Katengeza et al., 2011).

Figure 9 shows that 92% of young farmers on ag-platforms in Uganda have access to mobile phones, 35% have access to the internet and over 60% use mobile money and are a part of a farmers' group. In comparison, 90% of young farmers who do not use ag-platforms have access to mobile phones and 25.5% have access to internet, but only 18% are part of farmers' groups. In terms of digital skills, we classify basic digital skills as the use of mobile phones, primarily for SMS messaging, phone calls and playing games. High digital skills are defined as the use of mobile phones primarily to access apps, surf the web and use mobile money. In our sample, 64.5% of young ag-platform users have basic digital skills, but only 35.44% have high digital skills.

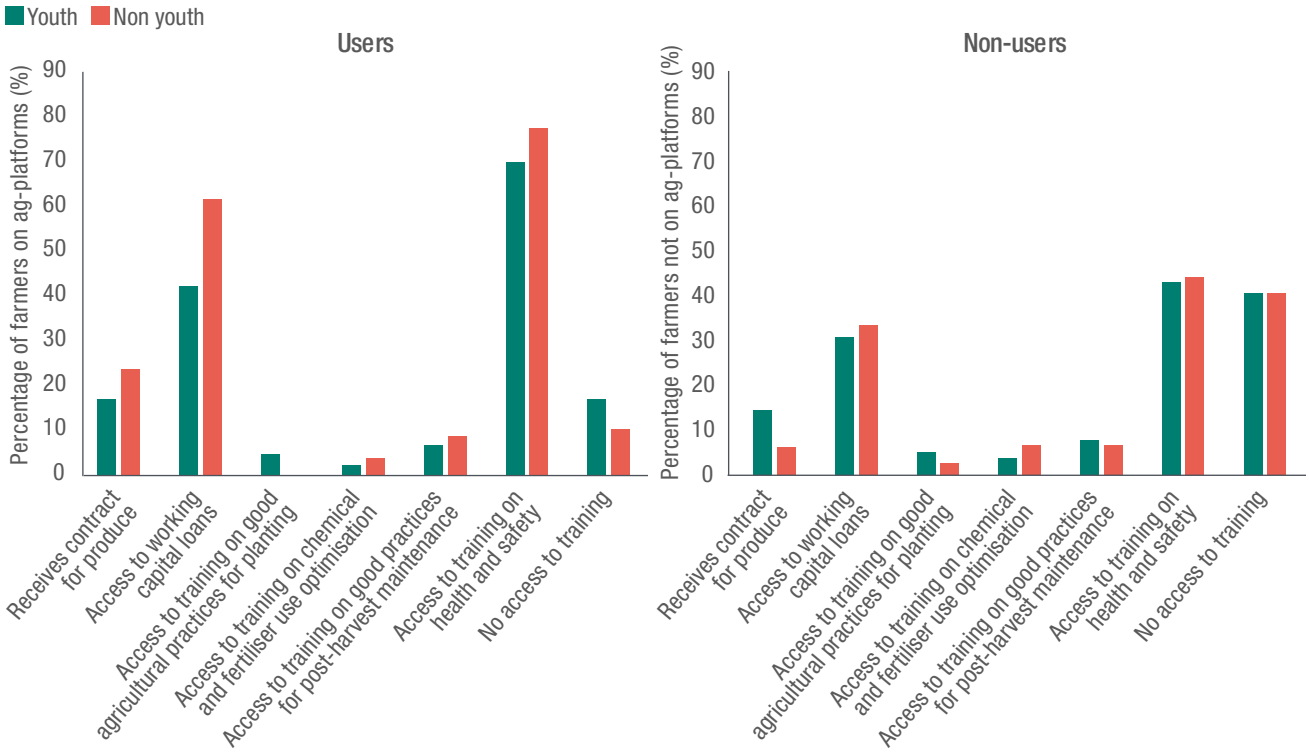
In relation to the formalisation of work for youth, Figure 10 suggests that 17% of young ag-platform users receive a contract for their produce, compared to 14.5% of young non-platformised farmers in the sample. Similarly, 42% of young platformised farmers have access to working capital, compared to roughly 31% of young non-platform users. Youth who are on platforms seem to have higher access to training; only 17% of young platform users report no access to training, compared to 40.7% of those who are not. Of those on platforms, roughly

**Figure 9 Digital skills and access, by platform use and age group**




Notes: total sample, *N* = 821; users, *N* = 433; youth, *N* = 395. Youth is defined as age group 18–35.

**Figure 10 Formalisation of work and access, across platform use and age group**




Notes: total sample, *N* = 821; users, *N* = 433; youth, *N* = 395.

70% of the young farmers report access to health and safety training, but access to other kinds of training appears to be low. In sum, youth on platforms appear to be doing better than non-platformised youth in terms of digital access and access to training.

### 4.2.5 Opportunities for women

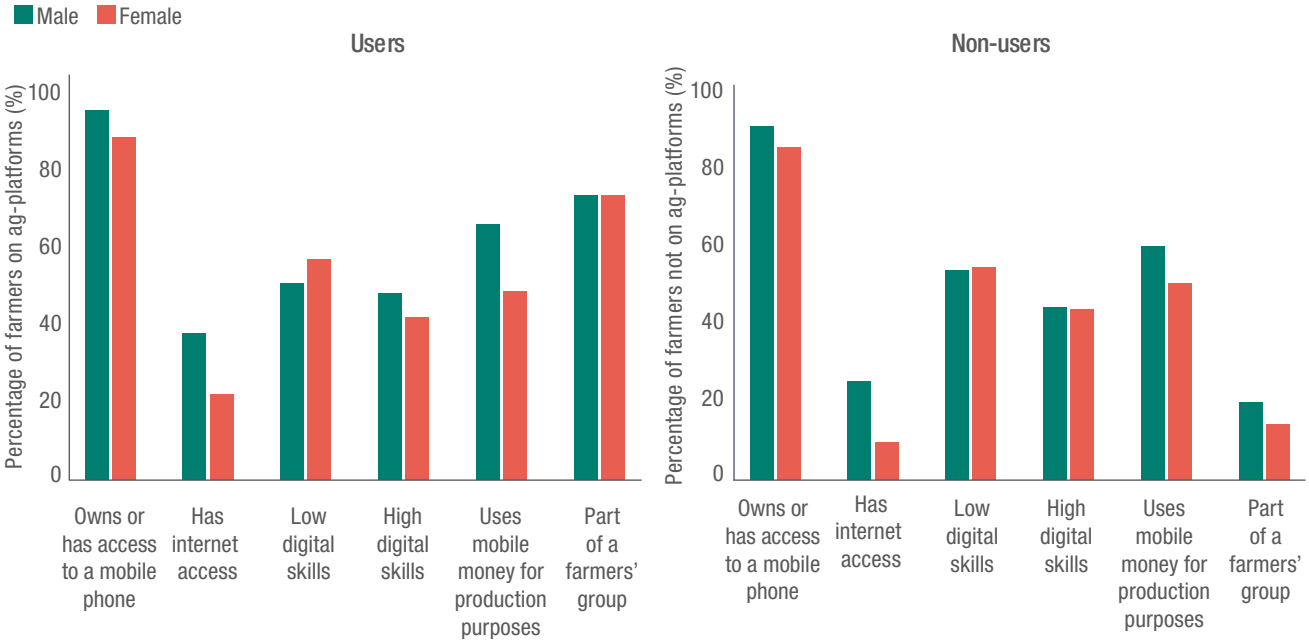
Ag-platforms have the potential to reduce the gender gap by improving access to digital skills, finance/credit and work opportunities, by reducing information asymmetries and training gaps, and by supporting the creation of a level playing field (Krishnan et al., 2020a). However, technology is not gender neutral, and persistent gender gaps in access affect men and women differently, deepening the exclusion of women in the agricultural sector (Adam et al., 2018; Schut et al., 2016).

Figure 11 analyses digital accessibility by gender and finds that women, whether they are users of ag-platforms or not, have less digital access than men. In the case of non-users, 25.55% of men report having access to internet, compared to only 9% of women. In the case of platform users, a higher share of both men and women have access to the internet, but the gap persists; 38.17% of men, compared to 22.4% of women, report having access to internet. A small number of women who have no access to a phone were still able to access the platforms' services but only every two weeks or once a month through the village agent, potentially missing out on real-time services. Female users tend to have more limited digital literacy than male users: 42.44% of female users have high digital skills, compared to 48.5% for male users.

In relation to participation in ag-platforms, the research suggests that women who are part of farmers' groups are more likely to participate than those who are not, as seen in Figure 11, which shows that almost 75% of female ag-platform users are part of farmers' groups, compared to just 14.29% of non-platformised female farmers.

When it comes to the inclusion of gender and youth across ag-platform models, we find that around 44% of the farmers in production and exchange platforms were women, compared to

**Figure 11 The digital gender divide and accessibility**




Note: total, *N* = 821; users, *N* = 433; non-users, *N* = 388; female, *N* = 353; male, *N* = 468; youth, *N* = 395; non-youth, *N* = 426.

only 36% for trading and sharing models, as shown in Table A4 in Annex 3. As mentioned in the discussion in Chapter 2, women are under-represented across all platforms. In contrast, youth account for between 53% and 58% of the participation in ag-platforms across each of the models.

Another factor that is likely to affect the adoption of digital platforms across gender is access to education. In India, Cole and Fernando (2012) find that the significant treatment effects of the digital platforms on agricultural knowledge are relatively higher for farmers with better education. In Kenya, the more educated, urban and richer individuals and those in the non-farm sector use M-Pesa almost twice as often as the less-educated, rural residents, poorer individuals and those employed in the farm sector (Mbiti and Weil, 2014).

In Uganda, important differences can be seen in the levels of education across male and female ag-platform users; survey data shows that while 42% of the women have completed primary education, less than 20% have undertaken further studies, 12% have no formal education, and 7% have only had an informal education. In comparison, 27% of the men have completed primary education, 26% have had some intermediary education, 22% have completed secondary education and 8% have had a university education (compared to just 2% of the women).

The agricultural productivity gap between women and men in sub-Saharan Africa averages around 20% to 30% (Kilic et al., 2015). Digital platforms can, to some extent, help to close this digital divide. Jain et al. (2012), for example, report improved productivity in India for female users of ICT-supported agricultural extension services, as well as their increased contribution to household decisions. In northern Uganda, the use of mobile phones and radios for real-time information has contributed to a perceived increase in productivity for women users (Mpiima et al., 2019).

Taking the sub-sample of maize farmers, however, Table 13 shows that while there is no significant yield differential between male and female farmers who are not using an ag-platform, male maize farmers on platforms appear to have significantly higher yields than female maize farmers on platforms. This suggests that while ag-platforms can facilitate productivity gains, the digital gender divide is a barrier to equitable

**Table 13 Differentials (tons/acre) across platform use and gender**

| Yield | Number of farmers | Coefficient | Standard error |
|---|---|---|---|
| **Platform users** | | | |
| Male | 103 | 0.813*** | 0.052 |
| Female | 67 | 0.584 | 0.055 |
| **Non-platform users** | | | |
| Male | 115 | 0.625 | 0.041 |
| Female | 64 | 0.564 | 0.064 |

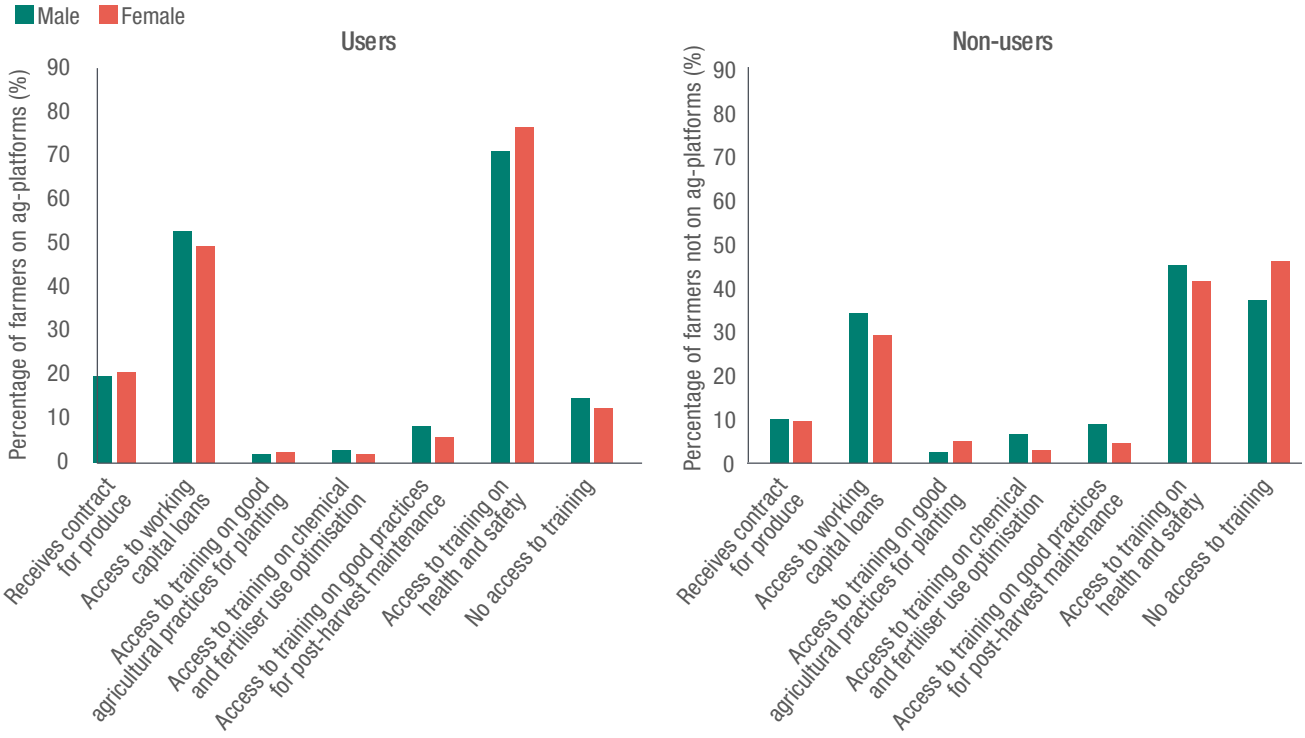
*** Significant at 1%.

productivity gains – a barrier that could be exacerbated by other major challenges, such as lack of tenure security, informal institutional constraints and intra-household dynamics (Kilic et al., 2015).

When we looking at formalisation outcomes of work across gender (Figure 12), we observe that women on platforms are doing better. Around 21% of female farmers on platforms have received a contract for their produce and 49.5% have access to working capital loans, compared to 9.32% and 29% of non-platformised female farmers respectively. Only 12.5% of female ag-platform users report having had no access to training, compared to 46% of female farmers who do not use these platforms.

Ag-platforms may also improve women's empowerment – a concept that goes beyond gender equality to encompass the experience of individuals or groups of autonomy in decision making (Alkire et al., 2013). It should be noted that greater empowerment in one domain – such as agriculture – does not necessarily translate into empowerment across other domains, such as protection from violence or greater autonomy in decision-making on other aspects of livelihoods. Even so, Table 14 shows that 91% of platform users reported that women could report abuse

**Figure 12 Formalisation of work, across gender**




Source: Uganda ag-platform survey, 2019

**Table 14 Changes to women's empowerment in Uganda – farmers' perceptions**

| Percentage of respondents reporting (%) | Responses from ag-platform users (%) | | | Responses from ag-platform non-users (%) | | |
|---|---|---|---|---|---|---|
| | More spent on women's education and healthcare than last year | Women can report abuse more easily than last year | Women work more hours in field than last year | More spent on women's education and healthcare than last year | Women can report abuse more easily than last year | Women work more hours in field than last year |
| Men | 73.44 | 90.87 | 58.51 | 63 | 79.3 | 44.49 |
| Women | 75 | 92.19 | 58.33 | 67.08 | 78.26 | 55.28 |
| Overall | 74.13 | 91.45 | 58.43 | 64.69 | 78.87 | 48.97 |

Note: users, *N* = 433; non users, *N* = 388; female, *N* = 353; male, *N* = 468 youth, *N* = 395; non-youth *N* = 426.
Source: Uganda ag-platform survey, 2019

more easily than in the previous year, compared with 79% of non-users. This is in line with findings from Alkire et al. (2013), where women empowered in agriculture production in Uganda also reported greater autonomy in other decision-making areas.

The literature confirms that greater autonomy in decision-making for female farmers has a positive impact on nutrition and food security, but also on educational outcomes (Alderman et al., 1995; Meinzen-Dick et al., 2011; Quisumbing and Maluccio, 2000; World Bank, 2009). In this sense, 39% of women users report an increase in spending on the types of food they purchase, compared to 34% of women who do not use ag-platforms. Similarly, the 75% women users who report an increase in spending on education or healthcare for women compared to the previous year can be contrasted with the 67% of female non-users who report the same increase – a gap of 8 percentage points.

One potential risk for women users, however, is male takeover of their production once it has become financially lucrative. This has been seen in some cases (Momsen, 2010; World Bank, 2009), in particular because the power imbalances that lead to unequal decision-making persist within many households (Quisumbing, 2003; Beuchelt, 2016).

## 4.3 Does participation in ag-platforms improve productivity?

In this section, we undertake econometric modelling to estimate the causal impact of ag-platforms on the labour productivity of farmers, calculated as their output divided by the total number of labourers employed on the farm. Given that we expect farmers to self-select into ag-platforms, it is likely that there is some bias in the coefficient that explains the impact of participation in these platforms on labour productivity. Some ag-platform farmers may be more efficient and have more labour productivity, leading to an overestimate of labour productivity as a whole.

It is possible to use a Heckman selection model to correct this, but the model still assumes that the labour productivity function would differ only by a constant term between farmers who use ag-platforms and those who do not. In reality, however, the interaction may be more systematic, as some of the variables may affect both participation and labour productivity. Van Den Broeck et al. (2017) have used propensity score matching, which helps to unpack some systematic differences but only based on observables. In our model, we claim that unobservable factors such as intrinsic ability have an influence on farmers' participation in ag-platforms and labour productivity. The switching regression (Maddala, 1983) helps to account for this. Using an Endogenous Switching Regression Model (ESRM) treats ag-platform versus non-platform value chains as a regime and

allows for structural differences between farmers' productivity across these chains.

We deploy, therefore, the ESRM, using the MOVESTAY command in STATA, which runs Probit simultaneously to model the decision of farmers to take part in an ag-platform and models the outcome variable: in this case, labour productivity. For ESRM, the Probit equation requires at least one exclusionary restriction, i.e. a variable that influences the decision to participate in platforms, but does not influence labour productivity. In this case, we use ownership of a mobile phone as an instrument. Point-bi-serial correlation tests show that this variable has no significant correlation with labour productivity and can, therefore, be used as an instrument.

**Table 15 Selection into ag-platforms**

| Variables | Model 1 | Model 2 |
|---|---|---|
| Given a contract | 0.387*** | 0.129 |
| | (0.145) | (0.159) |
| Age | –0.00921** | –0.0118*** |
| | (0.00358) | (0.00403) |
| Follows quality parameters | 0.290 | 0.0667 |
| | (0.182) | (0.200) |
| High skill | –0.149 | –0.113 |
| | (0.101) | (0.109) |
| Post-harvest training | 0.347** | 0.301* |
| | (0.154) | (0.154) |
| Health and safety training | 0.390*** | 0.299** |
| | (0.131) | (0.130) |
| Chemical use training | –0.104 | –0.188 |
| | (0.167) | (0.176) |
| Agricultural practices training | 0.351** | 0.290* |
| | (0.158) | (0.163) |
| Male | –0.143 | –0.161 |
| | (0.0990) | (0.108) |
| Access to internet | 0.257** | 0.218* |
| | (0.118) | (0.129) |
| Access to working capital loans | 0.385*** | 0.205* |
| | (0.103) | (0.115) |
| Part of a farmers' group | | 1.406*** |
| | | (0.112) |
| Constant | –0.560** | –0.605** |
| | (0.236) | (0.264) |
| Observations | 755 | 755 |

Note: Robust standard errors in parentheses; *** $P < 0.01$; ** $P < 0.05$; * $P < 0.1$.

Table 15 reports the result of an independently run Probit model, where the dependent variable is platform use. For farmers using ag-platforms, this variable takes the value 1, otherwise 0. The results show that farmers who have access to health and safety training, post-harvest training and agricultural practices training are far more likely to use ag-platforms. Similarly, farmers who have access to the internet and working capital loans are also far more significantly likely to use such platforms.

Farmers who are part of farmers' groups and younger farmers are more likely to participate on ag-platforms. All of these factors are in line with the findings discussed earlier that access to services and being part of a farmers' group are important factors that shape participation in ag-platforms.

Table 16 reports the results of a productivity equation, estimated jointly with the selection equation of self-selecting in ag-platforms. We observe that Rho1 is significant at 10%, indicating that there is a problem of self-selection into platforms (addressed by our model). Rho1 < Rh0 indicates that platform farmers are more productive than they would be if they were not using an ag-platform. As discussed in previous sections, these platforms can provide greater access to input services, reduce information asymmetry, and facilitate better access to inputs – all of which can increase productivity.

Through the survey, we aim to triangulate our findings using *perception* data to gauge the willingness of farmer to continue to use an app. Figure A3 in Annex 3 maps out the perception of ag-platform users in terms of the benefits they gain from these platforms. Over 80% of the 433 users agree that ag-platforms provide them with the ability to share knowledge with their friends and family, while increasing access to better quality inputs and improving crop quality.

We also show the likelihood ratio test for joint independence of the three equations.

The test statistic suggests that there is significant dependence between the selection and two productivity equations. This is further evidence of endogeneity, which is controlled for in our specification.

The results suggest that conditional on being part of an ag-platform, access to internet and to working capital has a positive and significant impact on farmers' agricultural productivity. Platform users who receive a formal contract for their produce are found to be statistically significantly more productive, while those who struggle to find a buyer are less productive.

Surprisingly, ag-platform users who are part of a farmers' group have significantly lower productivity than those users who are not part of such groups. There are two major reasons for this: intra-farmer group power dynamics, and the type of commodity that is produced. On the former, several papers have found power asymmetries between members of a farmers' group, leading to the formation of elite groups who gain faster and better access to information and receive most of the benefits, while many others within the group are excluded (e.g. Ortmann and King, 2007; Krishnan, 2018; Krishnan and Foster, 2018). On the latter, research suggests that certain commodities, like maize and potatoes (because of their high-volume to low-cost ratio) often have fewer farmers' groups and that these groups are not well funded, which hampers their efficacy (e.g. Mwaura, 2014; Izekor and Alufohai, 2010).

**Table 16 Endogenous switching regression model (jointly estimated with the selection equation)**

| | Log productivity_non-users | | Log productivity_users | |
|---|---|---|---|---|
| **Variables** | **Coefficient** | **Standard error** | **Coefficient** | **Standard error** |
| Part of farmers' group | –0.152 | (0.209) | –0.526*** | (0.187) |
| Age | 0.00480 | (0.0383) | 0.0553 | (0.0503) |
| Age sq. | –6.02e-5 | (0.000406) | –0.000645 | (0.000607) |
| Chemical use training | 0.154 | (0.193) | 0.126 | (0.187) |
| Own a dwelling | –0.189 | (0.315) | –0.201 | (0.312) |
| Access to internet | –0.163 | (0.263) | 0.410** | (0.188) |
| Access to working capital | 0.417** | (0.192) | 0.335* | (0.171) |
| Married | 0.0166 | (0.244) | 0.00543 | (0.216) |
| Difficulty in finding buyer | –0.402** | (0.182) | –0.439** | (0.185) |
| Given a contract | 0.0781 | (0.319) | 0.457* | (0.244) |
| Constant | –1.459** | (0.731) | –2.367*** | (0.902) |
| Rho0 | 0.27 | (0.14) | | |
| Rho1 | | | –0.24* | (0.07) |
| Wald test:<br>Probability > $\chi 2 = 0.0032$<br>Observations | 821 | | 821 | |

Note: Robust standard errors in parentheses *** $P < 0.01$; ** $P < 0.05$; * $P < 0.1$. Here, the instrument used is ownership of mobile phone (coefficient in the selection equation is positive and significant at 1%).

# 5 Conclusions and policy implications

This report has aimed to map the landscape of ag-platforms in Uganda, drawing on our 2019 survey of 821 farmers. It has focused on two key issues. First, the extent to which ag-platforms have facilitated or inhibited value capture through five channels:

- access to productivity-enhancing services
- market access, diversification and value addition
- formalisation of work and income
- women empowerment
- youth inclusion

Second, it has examined the impact of ag-platforms and other factors on the productivity of farmers.

Data were collected through a 2019 survey of 821 farmers in Uganda (433 platform users and 388 non-platform users) and complemented with interviews. We studied four main ag-platforms: E-Voucher, MUIIS, EzyAgric and KOPGT. Of platform-user farmers, most (approximately 49%) are using the platform E-Voucher, followed by MUIIS, with 56 farmers enrolled, then EzyAgric, with 49 of the 433 farmers enrolled on it. Seven farmers are using KOPGT, and 109 are enrolled on other platforms. The primary crops used on the platform are maize, coffee, soyabean, cassava and palm.

The research indicated that the most common forms of ag-platforms in Uganda are production and exchange models. These provide production and post-production training and input services (amongst non-users, 40% of farmers have no access to training, falling to 13.8% for platform users). However, with most farmers joining platform to find markets and buyers, these production and exchange models fall short of meeting their needs, even though they provide training in the best agricultural practices. This raises questions about the sustainability of the production and exchange business model.

We have identified five value-creating pathways where there is a clear difference between those who use ag-platforms and those who do not:

1. **Productivity (crop and labour):** the results indicate that ag-platform users whose primary crop is maize achieve yields that are, on average, 18% higher than those achieved by non-platform users. This may be the result of ease in finding buyers, ownership of ICT assets (e.g. a mobile phone) and access to the use of ag-platform input services. Further econometric results indicate that ag-platform users have significantly higher labour productivity gains.
2. **Value-addition and diversification:** the results indicate that participation in an ag-platform facilitates access to multiple new markets, but does not promote new product diversification. This is because the information provided by apps is targeted to specific products, rather than being broad ranging.
3. **Formalisation of work and income:** the results indicate that ag-platform users fare better in terms of receiving a contract for their produce and in accessing working capital and training. A higher share of users report an increase in non-production related expenditures, particularly for the type of food and assets they purchase.

4. **Youth:** the data show that farmers under the age of 35 were more likely to be registered on an ag-platform compared to older cohorts, and that more employment was generated as a new class of youth leader emerged. These are educated youth who act as intermediaries between farmers and the ag-platform, helping other farmers to register and exchanging information between the parties involved.
5. **Gender:** the data suggest that female users have lower digital literacy and overall education than male users, and less access to digital technology than men. Even among ag-platform users, male farmers who produce maize are found to be more productive than female farmers, indicating that the gains from ag-platforms are not evenly distributed. In terms of the formalisation of work, women on platforms do better than women who are not on these platforms.

We have identified six policy priorities from our research:

1. **Ensure institutional oversight:** the rate of rejection of produce by buyers and the losses incurred as a result of inadequate storage facilities are long-standing issues that inhibit the capacity of farmers to improve their productivity. The data show that more ag-platform users reported the rejection of their produce, with the share of these rejected products to total output higher among users (24%) than non-platform users (20%). This indicates that they are selling to buyers who have higher standards and reject more produce. Ag-platforms need to support improvements in the quality standards of produce, provide monitoring during production and sale, and perform evaluations to understand areas that need improvement during the growing stage to minimise rejection losses. The Ministry of Agriculture, Uganda National Bureau of standards, and the Federation of Small and Medium-scale Businesses in Uganda can work with ag-platforms to develop local food standards and quality benchmarks. In addition, effective monitoring and oversight is required during the grading and aggregation of products post-harvest to ensure that the food makes the 'right grade' – again, to reduce rejection.
2. **Increase access to working capital:** our data show that 51% of platform users have access to working capital loans, compared to 32% of non-platform users. Within this, about 50% of female platform users have access to working capital loans, compared to 29% of non-platform users. Access to working capital has a direct and positive impact on the productivity of ag-platform farmers.
3. **Address challenges with the ag-platform models:** logistics are a key cost associated with moving products within a value chain, i.e. from farm gate to the intermediary/buyer and further downstream. None of the apps sampled in Uganda provide logistical support to farmers. This lack of logistical support is compounded by the insufficient capacity of the Ugandan Warehousing Authority to store farmer produce or provide commodity receipts. The provision of logistical and storage facilities has been shown to improve the incomes of farmers in other parts of Africa (e.g. Donaldson et al., 2018).
4. **Increase the effectiveness of farmers' groups:** these can be formal cooperatives (if they are registered under the Uganda cooperative act) or informal (if formed through bottom-up action via like-minded farmers who come together to form a group), or top-down (if they are formed by ag-platform themselves or by village leaders). Our research finds that farmers' groups seem to have a negative effect on productivity. There are two major reasons for this: intra-farmer group power dynamics and the type of commodity that is produced. On the former: several papers have found power asymmetries between members of a farmers' group, leading to the formation of an elite group who capture access to information and receive most of the benefits, while others within the group are excluded (e.g. Ortmann and King 2007; Krishnan, 2018; Krishnan and Foster, 2018). On the latter: certain commodities like maize and potatoes (given their high-volume to low-cost ratio) often have fewer farmers' groups and these are not well funded, which reduces their impact (e.g. Mwaura, 2014; Izekor and Alufohai, 2010).

5. **Address gender gaps:** there are significant gender gaps in terms of registering with an ag-platform. Among ag-platform farmers who growing maize, for example, only 67 women were registered to the relevant platform, compared to 107 men. Women were also seen to have more limited digital skills than men, and much lower access to the internet. Women on ag-platforms also seemed to have lower crop yields compared to men, especially in maize – the result, in part, to gaps in access to the services that can generate productivity gains. There are, however, some positive aspects when we compare women on ag-platforms with those who are non-users. For example, 49.5% have access to working capital loans, compared to 29% of non-platformised female farmers. It is imperative for ag-platforms to ensure that women have equal access to the services they provide.
6. **Increase skills development and training for youth:** our research finds that only 35.44% of young platform users have high digital skills (i.e. they use mobile phones primarily to access digital apps, browse the web or for mobile money). Targeted initiatives are needed to increase access for young farmers to digital and soft-skills training. While youth on platforms have greater access to health and safety training, access to other types of training (such as on agricultural practices, chemical use, etc.) appears to be low.

## 5.1 Take-aways for policy-makers

This research shows that ag-platforms have generated several positive gains in terms of productivity enhancement, knowledge exchange and accumulation, and greater youth participation. They have also created many partnerships across civil society, the private sector and governments to ensure service delivery, creating an ecosystem of support for the farmer.

At the same time, however, ag-platforms have been shown to reproduce and even exacerbate existing divides, and may well have worsened the digital gender divide in particular. Their implication for the quality of the produce and the rate of rejection is also mixed, repeating existing patterns of power asymmetry between buyers and farmers in a way that is similar to traditional value chains.

There is a pressing need, therefore, to leverage the positive aspects of ag-platforms, rather than reproducing their negative impact. The positive aspects of various ag-platforms can be identified through monitoring and evaluation, and through frequent economic and social audits. Taken together, such action can highlight the services that should be the focus within each platform, and those that could easily be shed. This has the potential to create more specialised ag-platforms and give farmers with a better deal, distributing profits more easily – and equally – across the value chain.

The different types of models of platforms unpacked in this paper provide a starting point for the identification of the type of ag-platform that can succeed. For example, trading and sharing models, as well as production and exchange models, are more common than those that are single-buyer-led. Yet the benefits are mixed, as production and exchange models fail to support some of the most important needs of the farmer, particularly finding a buyer, while trading and sharing models charge very high commissions. Audits can help us understand not only which model works best for 'whom', but also which services within each model have the greatest chance of success.

Policy-makers can use the results of such audits to create funding schemes or revolving credit schemes for certain ag-platforms that will enable them to grow. At the same time, partnerships, which are the foundation for effective ag-platforms, can be strengthened with the support of the government.

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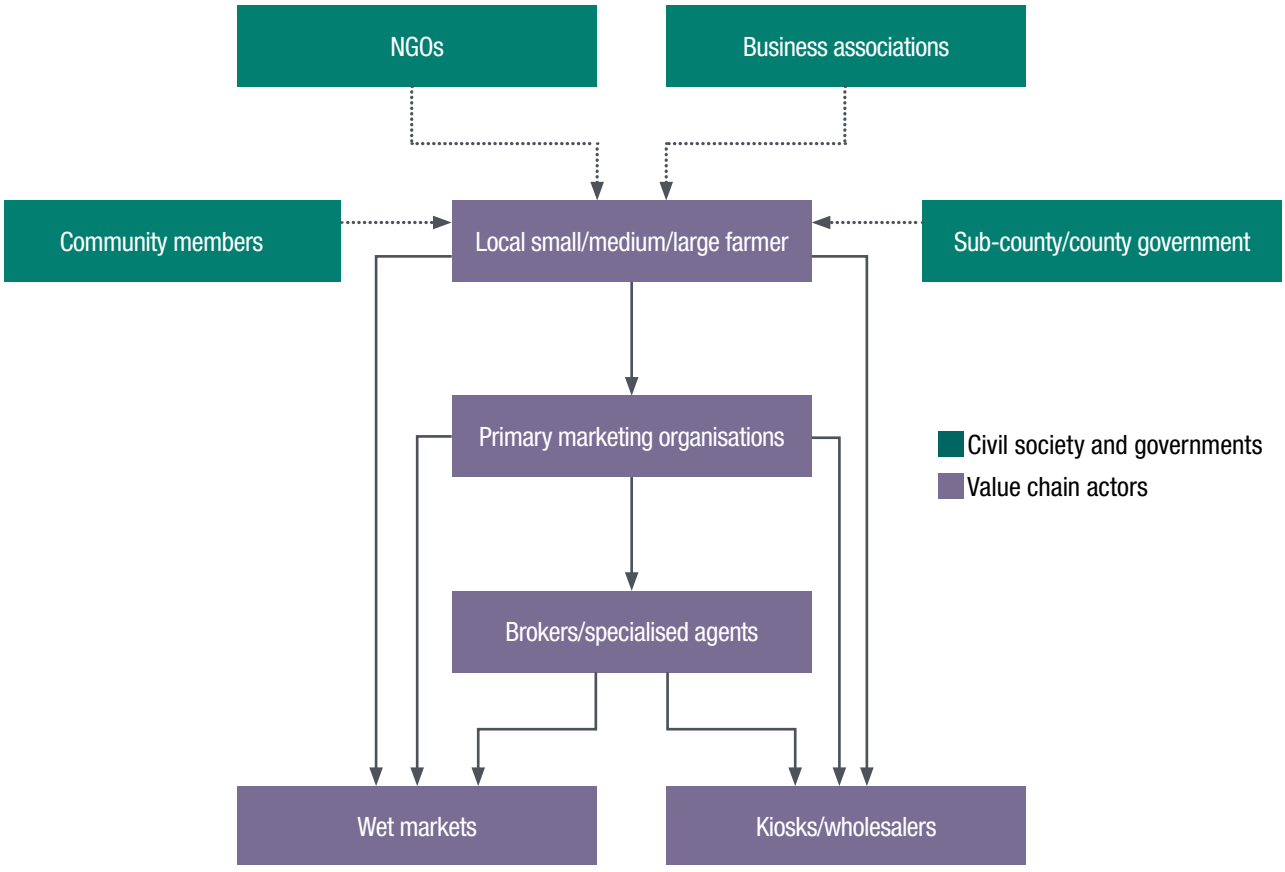
# Annex 1 List of interviews

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

# Annex 2 Traditional agricultural value chain in Uganda

In a traditional domestic value chain, farmers can either sell into local wholesale markets, kiosks or wet markets directly or through brokers (Okello et al., 2007; Rao and Qaim, 2011), which are depicted by black lines in Figure A1. Frequently, farmers form a primary marketing organisations (PMO) or a growing cooperative (GC) and sell either to wholesalers/ kiosks or intermediaries. Almost no food standards exist, with quality judged based on visual appearance and there is no requirement for traceability. Most of the support received by local farmers, as depicted by the dotted line in Figure A1, emanates from community members, while some training is disseminated via extension officers (sub-county and area officers), NGOs and cooperatives.

**Figure A1 Traditional domestic value chain in Uganda**



# Annex 3 Ag-platform services and features

**Table A1 Input and post-harvest services of ag-platforms**

| Type of service | Service | Ag-platform model | | | |
|---|---|---|---|---|---|
| | | Production and exchange (%) | Integrated single-buyer (%) | Trading and sharing (%) | Other (%) |
| Input | Good agricultural practices on planting | 75.55 | 100.00 | 82.00 | 70.43 |
| Input | Chemical and fertiliser use | 69.34 | 100.00 | 82.00 | 70.43 |
| Input | Weather updates | 53.65 | 42.86 | 38.00 | 48.70 |
| Input | Pest control or disease related updates | 56.57 | 71.43 | 44.00 | 57.39 |
| Post-harvest | Market crop prices | 68.98 | 57.14 | 54.00 | 66.09 |
| Post-harvest | Farmers that reported rejected produce | 12.77 | 42.86 | 16.00 | 9.57 |
| | **Total (number)** | **274** | **7** | **50** | **115** |

**Figure A2 Crop productivity – maize (tons/acre), by ag-platform model**

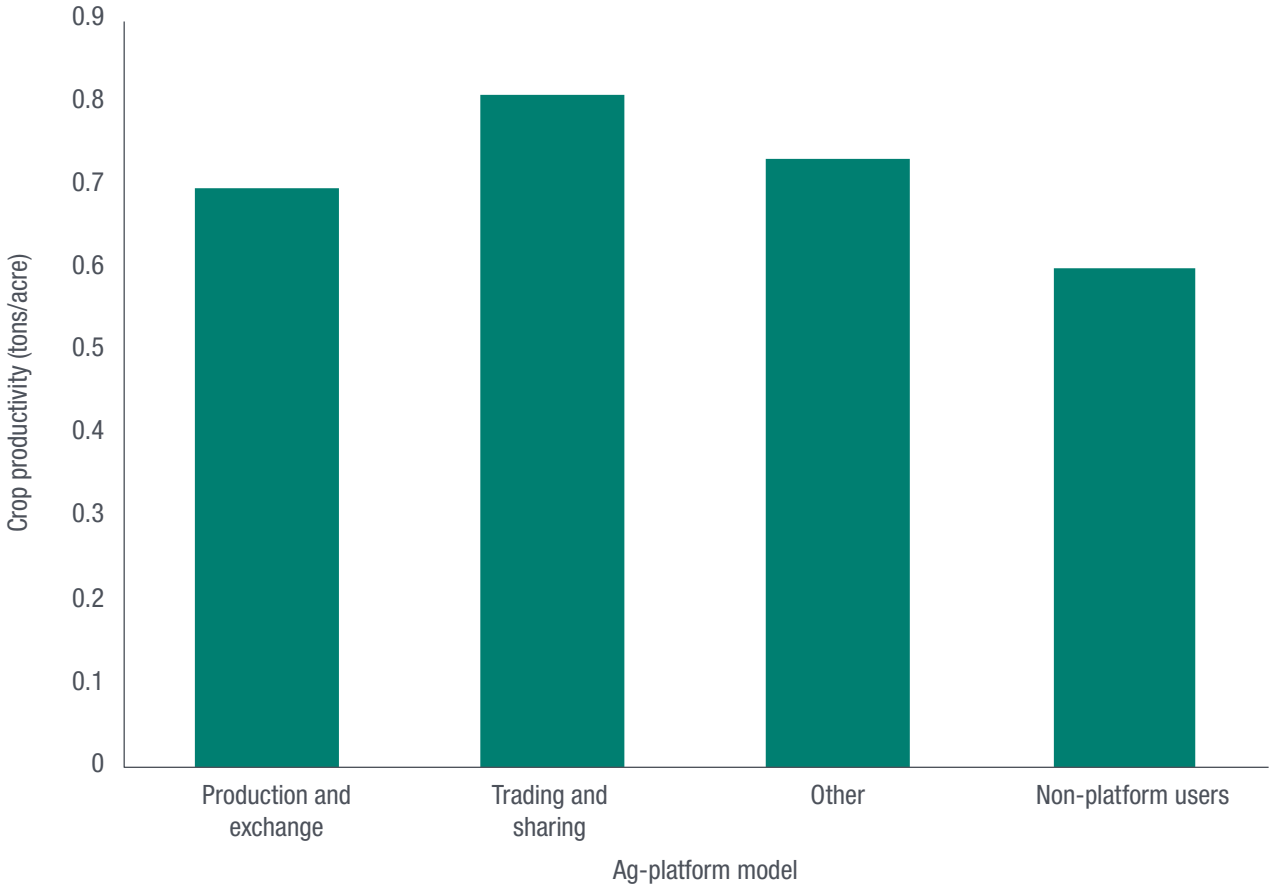



**Table A2 Value capture, by ag-platform model**

| Value capture | Ag-platform model | | | |
|---|---|---|---|---|
| | Production and exchange (%) | Integrated single-buyer (%) | Trading and sharing (%) | Other (%) |
| Diversification: new products | 17.88 | 0.00 | 16.00 | 20.00 |
| Diversification: new markets | 4.38 | 0.00 | 2.00 | 11.30 |
| Value addition: processing | 13.50 | 14.29 | 16.00 | 16.52 |
| Value addition: packaging | 10.22 | 0.00 | 10.00 | 7.83 |
| Farmers that reported ease in finding a buyer | 33.94 | 57.14 | 38.00 | 20.87 |

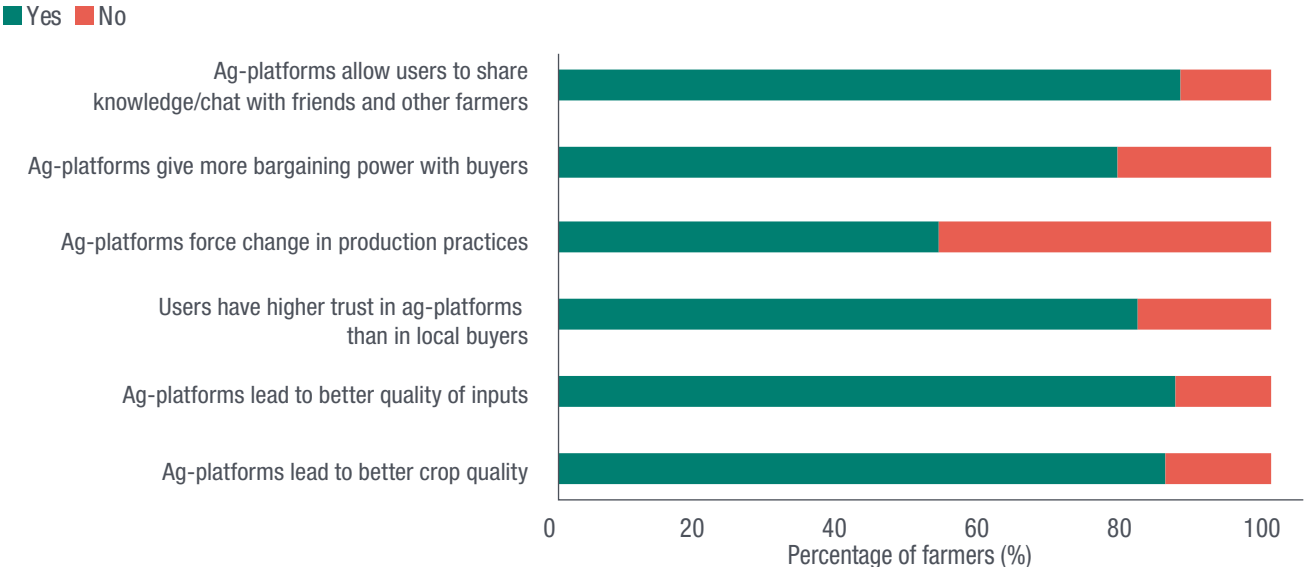
**Table A3 Formalisation of work, by ag-platform model**

| | Ag-platform model | | | |
|---|---|---|---|---|
| | Production and exchange (%) | Integrated single-buyer (%) | Trading and sharing (%) | Other (%) |
| Access to working capital | 52.92 | 85.71 | 40.00 | 50.43 |
| Receives contract for produce | 21.90 | 85.71 | 18.00 | 13.91 |

**Table A4 Gender and youth inclusion, by ag-platform model**

| | Ag-platform model | | | |
|---|---|---|---|---|
| | Production and exchange (%) | Integrated single-buyer (%) | Trading and sharing (%) | Other (%) |
| Proportion of women in each model | 44.16 | 42.86 | 36.00 | 46.09 |
| Proportion of youth in each model | 53.65 | 57.14 | 58.00 | 43.48 |

**Figure A3 Farmers' perceptions of ag-platforms**




Note: Ag-platform users only; $N = 433$.

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