GSMA

Improving Farmer Livelihoods Through Digitised Agricultural Value Chains

Results and lessons from the GSMA Innovation Fund

GSMA

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The GSMA AgriTech programme works towards equitable and sustainable food chains that empower farmers and strengthen local economies. We bring together and support the mobile industry, agricultural sector stakeholders, innovators and investors in the agritech space to launch, improve and scale impactful and commercially viable digital solutions for smallholder farmers in the developing world.

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Acronyms

AI	Artificial Intelligence	**MFI**	Microfinance Institution
AMCOS	Agricultural Marketing Cooperative Society	**MMP**	Mobile Money Provider
B2B2C	Business-to-Business-to-Consumer	**MNO**	Mobile Network Operator
B2C	Business-to-Consumer	**NGO**	Non-Governmental Organisation
BI	Business Intelligence	**OBD**	Outbound Dialling
BKK	BaKhabar Kissan	**P2P**	Peer-to-Peer
CRM	Customer Relationship Management	**RFID**	Radio Frequency Identification
DFS	Digital Financial Services	**SACCOS**	Savings and Credit Cooperative Society
FSP	Financial Service Provider	**SMS**	Short Message Service
GDP	Gross Domestic Product	**ToC**	Theory of Change
GPS	Global Positioning System	**ToT**	Training of Trainers
IVR	Interactive Voice Response	**USSD**	Unstructured Supplementary Service Data
LMIC	Low- and Middle-Income Country	**UX**	User Experience
MEL	Monitoring, Evaluation and Learning	**VAS**	Value-Added Services

How to navigate this report

Click on each chapter image to take you to the corresponding section of the report

Executive summary

The executive summary presents a summary of the report

The executive summary captures the key findings in terms of service adoption, the benefits of digitisation for smallholder farmers and service providers and the impact of digital agriculture services on smallholder incomes and climate resilience.

1 Introduction

The introduction presents the scope of the report

The introduction covers the problem statement underlying the GSMA Innovation Fund's creation, an overview of supported grantees and their services as well as the report objectives, methodology and data sources used to extract results and lessons.

2 Adoption and perceived impact of services supported by the GSMA Innovation Fund

This is the core section of the report, presenting the results and impact of the GSMA Innovation Fund

This section opens with key results on service adoption before delving into the design, adoption and implementation of each of the services (digital procurement, payments, advisory, loans and insurance). It also explores the perceived impact of services on farmer incomes and climate resilience.

3 Lessons from the GSMA Innovation Fund

This chapter presents lessons and best practices from the GSMA Innovation Fund

Lessons and best practices are presented using a business model canvas approach to highlight what worked for grantees and what did not. It also highlights what grantees learned in terms of the impact and inclusivity of their services.

Conclusion

This section provides a one-page overview of the conclusions of the report

This concluding chapter reflects on the significance and key takeaways of the GSMA Innovation Fund and offers guidance for service providers aiming to introduce digital agriculture or B2C services to smallholder farmers, agribusinesses, and cooperatives.

Annexes

This section offers supplementary information to enhance the understanding of the report's findings

Annexes contain a glossary, detailed grantee profiles, some background information on the GSMA Innovation Fund, as well as survey size samples.

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Executive summary

Executive summary

The GSMA Innovation Fund for the Digitisation of Agricultural Value Chains (the "GSMA Innovation Fund") provided funding and technical assistance to mobile network operators (MNOs) and agritechs to develop, test and scale commercially viable digital agriculture solutions that improve smallholder farmer incomes, financial inclusion and climate resilience.

The GSMA Innovation Fund was implemented between May 2020 and December 2022 in Nigeria, Rwanda, Tanzania, Indonesia, Pakistan and Sri Lanka. It supported the launch of digital farmer profiles and procurement, digital payments, loans, insurance and digital advisory services, including agronomic advisory, weather forecasts and climate-smart advisory.

This report draws on business intelligence (BI) data from 1,400,542 digitally profiled farmers and 513,580 service users, as well as quantitative surveys, qualitative interviews with farmers and key stakeholder interviews. The GSMA AgriTech programme shares lessons about business models, service design and user uptake and feedback, and assesses the perceived impact of digital agriculture services on farmer incomes and climate resilience.

Key findings

Digital agriculture services supported by the GSMA Innovation Fund were scaled across 17 value chains and profiled more than 1.4 million farmers combined. Most of the farmers profiled are male (70.3%), smallholder farmers cultivating on less than two hectares of land (79.3%) and over 40 years of age (46%).

Women are underrepresented across digital agriculture services due to social and digital inclusion barriers. For example, gendered roles in farm households, lower levels of land ownership, mobile phone ownership and digital skills, and less trust in male purchasing clerks and agents all prevented women farmers from reaping the benefits of digital services, especially digital advisory and loans.

Younger farmers under 25 are still underrepresented among users, despite being a more tech-savvy demographic. The prevalence of older farmers among users is a reflection of ageing farming populations. On average, farmers older than 55, women and farmers with disabilities were less likely to recommend services than younger men without a disability.

Adoption and usage of digital agriculture services can only scale when they account for the diverse needs and capabilities of smallholder farmers. Specifically, digital agriculture services for smallholder farmers need to be adapted to low digital literacy levels, be relevant to small-scale production, an ageing demographic and should aim to be more inclusive of women farmers.

Services

Digital procurement helps agribusinesses that procure from smallholder farmers operate more efficiently, affordably and transparently. Farmers demonstrated high levels of acceptance and reported that digital scales and receipts were faster and more accurate than purchasing clerks manually recording sales transactions. Training purchasing clerks to use digital procurement record-keeping tools and raising awareness among farmers of digital profiles were critical to addressing initial scepticism. To ensure their services were relevant, providers tailored procurement software to the needs of agribusiness clients, purchasing clerks and smallholder farmers.

Farmers recognise the benefits of digital payments, including safety and better financial management. However, these benefits did not outweigh the challenges of fees, low awareness of digital finance and the lack of a value proposition in underdeveloped digital finance ecosystems. Digital payments have the potential to provide safer transactions and support the creation of digital economic identities for smallholder farmers. Digital payment services are better suited to agricultural value chains where there are multiple harvests a year, as these allow for more touchpoints with users. However, high transaction fees, low awareness and low liquidity at agent locations remain barriers to adoption. The challenges in scaling digital payments highlight the need for holistic approaches that tackle the policy environment, financial infrastructure, financial literacy, as well as service features and delivery. Tanzanian farmers subjected to a government mobile money levy during the GSMA Innovation Fund reported its negative impact on their incomes and saw a sharp decrease in usage. This further emphasises that working with local governments to strengthen enabling policy environments and infrastructure is key to support the uptake of digital payment services.

Digital advisory had more users than any other digital service. It offers a clear value proposition for farmers and benefits for agribusinesses and cooperatives. These benefits include more cost-effective deployment of agronomists, more frequent advice for farmers and higher crop yields. SMS and interactive voice response (IVR), which do not require data connectivity or high levels of digital literacy, have higher activity rates, are more inclusive for women smallholder farmers and non-smartphone users and are a better fit than app-based advisory. When digital advisory is interactive, behaviour change is greater, but a combination of digital and in-person advisory is necessary to be cost-effective and engage users. Weather forecasts have higher activity rates when they are offered on a separate channel rather than as part of generic agronomic advisory.

Input loans address a key farmer need and most smallholders had a positive experience applying for and receiving these loans. Input loans require robust logistics and partnerships with input suppliers since timely access to inputs is critical during the growing season. Lending regulations and, in some cases, limited balance sheet capacity, mean that agritechs and MNOs must rely on financial service providers (FSPs) to offer cash loans to farmers. Without partnerships with FSPs, financial inclusion remains a challenge as the input loans or small overdraft services offered by grantees do not address farmers' wider financing needs, such as labour and farm investments.

Insurance is slow to take off given insurance premiums and the lack of trust in insurance companies. Subsidising the cost of insurance or bundling it with inputs have proven effective strategies to boost adoption.

Impact on smallholder farmer incomes and climate resilience

61% of surveyed farmers perceived digital advisory as the biggest contributor to increased incomes. Advice on input and fertiliser management, planting and disease-related advice are believed to have the most impact. SMS and IVR-based advisory are more inclusive than app-based advisory as they do not require smartphones, and they also have more repeat users, making them better suited to increasing smallholder incomes.

50% of farmers see input loans as having a direct positive impact on their incomes. Timely access to quality inputs plays a major role in improving crop yields and incomes and requires robust logistics and reliable input suppliers. However, farmers also need broader loan offerings to pay for labour and invest in mechanisation, and this requires partnerships with FSPs.

Farmers link digital advisory with the ability to be better prepared for weather events, including extreme heat and droughts. Digital weather forecasts improve access to weather information and are considered equally useful for anticipating short-term and medium-term weather events. However, farmers need advice and training to implement actual climate adaptation practices, and service providers need to raise awareness of relevant, low-cost climate adaptation and mitigation strategies.

Farmers placed more emphasis on adaptation of farming practices and access to weather forecasts as ways to improve their climate resilience than on financial safety nets. Raising awareness of financial services for adaptation is key for farmers to consider savings and insurance as tools for absorbing climate shocks.

1 Introduction

Introduction

The agriculture sector faces major challenges in the 21st century, as it must feed a growing global population while climate change jeopardises productivity.[1] More than 30% of the world's food, and up to 80% of food consumed in Asia and Sub-Saharan Africa, is produced by smallholder farmers cultivating less than two hectares (2 ha) of agricultural land.[2] Smallholder farms provide livelihoods for more than 500 million households globally.[3]

Although agriculture is vital to the economies of low- and middle-income countries (LMICs), contributing 10% to 40% of GDP,[4] the smallholder farmers powering these economies are the most likely to go hungry. Smallholders account for 74% of the 1.1 billion extremely poor living on less than USD 2 a day.[5,6] Research in several agricultural value chains shows the average income of smallholder farmers is not enough to support a decent standard of living, and women farmers generally produce and earn even less.[7] This has pushed most youth to leave rural areas for higher-paying jobs in cities, depleting agriculture of its workforce. Raising smallholder farmer incomes and improving their livelihoods are the key to building sustainable food systems and increasing food security in the face of climate change.

1. FAO. (2017). The future of food and agriculture: Trends and challenges.
2. Ricciardi, V. et al. (2018). How much of the world's food do smallholders produce?
3. The Mastercard Foundation Rural and Agricultural Finance Learning Lab and ISF Advisors. (2019). Pathways to Prosperity: 2019 Rural and Agricultural Finance State of the Sector Report.
4. The World Bank Data. (2020). Agriculture, forestry, and fishing, value added (% of GDP).
5. Abumhadi, N., et al. (2012). Agricultural Research in 21st century: Challenges facing the food security under the impacts of climate change.
6. World Bank. (2018). Ending Poverty and Hunger by 2030: An Agenda for the Global Food System, 2nd edition.
7. Oxfam. (2018). A living income for small-scale farmers. Tackling unequal risks and market power.

Farmers face diverse and intersecting barriers to increasing their incomes.

Systemic and interrelated challenges explain why smallholder farmers are trapped in poverty.

Figure 1
Challenges faced by smallholder farmers

✻ Focus of the GSMA Innovation Fund for the Digitisation of Agricultural Value Chains

POOR ACCESS TO MARKETS

An estimated 60% of smallholder farmers operate in informal value chains with poor access to markets and buyers.[8] They rely heavily on intermediaries to sell their produce, leaving them vulnerable to volatile prices. Even when farmers operate in formal markets, lack of access to market information affects their ability to sell their produce at an optimal price.

POOR ACCESS TO INFORMATION SERVICES ✻

Smallholder farmers tend to rely on outdated farming techniques and lack access to critical information, including reliable weather and climate information, that could help them plan their farming activities, improve on-farm practices, reduce inefficiencies and increase per-hectare yields.

POOR ACCESS TO FINANCIAL SERVICES ✻

Most smallholder farmers globally have no, or limited, access to formal financial services like credit, loans, savings or insurance.[9] Lack of collateral, identification documents, financial history or formal employment makes it difficult for them to qualify for a loan. Access to formal financial services is also hindered by smallholder farmers' low financial literacy, low awareness and trust of FSPs, the nascent digital financial services (DFS) ecosystem in which they live and the high perceived costs of these services.

POOR PRODUCTIVITY ✻

Poor access to finance leads to other challenges, such as lack of access to quality agricultural inputs (seeds and fertilisers) and assets like machinery, irrigation systems and crop storage. All this contributes to low productivity.

CLIMATE CHANGE ✻

Smallholder farmers are under growing pressure from climate change given their reliance on natural resources and lack of access to appropriate risk-coping mechanisms. The increased frequency and intensity of extreme weather events like drought, hurricanes and wildfires, as well as rising temperatures and changing precipitation patterns, all threaten agricultural production.

RURAL INFRASTRUCTURE

Because farmers live in remote areas, they struggle to access basic services like mobile connectivity and new technologies. Roads and public transport are usually underdeveloped in rural areas of LMICs, making it difficult to travel to city centres to access services, assets and markets.

✻ Focus of the GSMA Innovation Fund for the Digitisation of Agricultural Value Chains

All these challenges lower the productivity and incomes of smallholder farmers. Women, youth, and persons with disabilities face even more constraints to their agricultural activities and tend to have lower agricultural productivity than men.

Smallholder farmers are not the only ones encountering roadblocks in the global food system. Agricultural organisations that procure from smallholder farmers, such as agribusinesses and cooperatives, still primarily use paper records for farmer profiles and to collect data and log transactions, which are time-consuming and prone to error. Paper records are also not compatible with certification and traceability programmes that buyers ask them to comply with. They also bear the high costs of disseminating information and procuring from smallholder farmers in remote locations. Cash is still prevalent when transacting with farmers, which also incurs significant costs and risks.

8. The Mastercard Foundation Rural and Agricultural Finance Learning Lab and ISF Advisors. (2016). Inflection point: Unlocking growth in the era of farmer finance.
9. CGAP. (2019). Smallholder Households: Distinct segments, Different needs.

Digital technologies can make value chains more efficient and boost farmers' productivity and incomes at scale.

According to the World Bank, increasing agricultural productivity within value chains is one of the most effective strategies to reduce poverty,[10] as it can raise farmers' incomes, increase food supply and reduce food prices.

In an enabling environment that supports the development and adoption of appropriate digital solutions, digital technologies can open pathways to higher incomes and agricultural productivity along the value chain.[11, 12] Digital technologies can help improve how resources and capital are used in the field, while off-farm they can help lower the costs associated with accessing markets and services.[13]

More specifically, the digitisation of agricultural value chains creates greater transparency, allowing smallholder farmers to improve their knowledge of agricultural practices, gain better access to markets and strengthen their decision-making power. Digitising procurement also enables a transition from cash to digital payments and from paper to digital records, creating a wealth of farm and farmer data that can be used to create economic identities for farmers. Economic identities can inform credit risk assessments, reduce the cost of service delivery and support financial inclusion, opening access to climate-related services such as insurance. When digital records and digital payments are combined with information services, these digital tools can radically shift productivity and incomes for farmers in the last mile.[14]

On top of the benefits for smallholder farmers, the digitisation of agricultural value chains also improves the efficiency and performance of commercial agricultural organisations that work with farmers, such as agribusinesses and cooperatives.[15] Digitised value chains provide a full and real-time picture of the supply chain, allowing them to better manage the quality of production while also providing an effective communication channel and optimising operations to increase profits.

However, many digital solutions in the agricultural last mile struggle to reach scale and truly improve the lives of smallholder farmers. For example, in 2019, most digital agriculture solutions in Sub-Saharan Africa had just 15% to 30% active users, while about 80% of farmer registrations came from just 5% of services.[16]

Agribusinesses and cooperatives offer a major opportunity to digitise the agricultural last mile and scale up the impact of digital agriculture solutions under a business-to-business-to-consumer (B2B2C) model. This would bypass some of the hurdles of business-to-consumer (B2C) models, especially the ability of farmers to pay for services themselves. Bundling digital agriculture services to address multiple pain points at once could be an effective way to subsidise access to services, improve quality and increase productivity.[17]

The GSMA Innovation Fund for the Digitisation of Agricultural Value Chains was created to increase the productivity, financial inclusion and climate resilience of smallholder farmers, with the end goal of improving farmers' livelihoods.

In 2020, the GSMA AgriTech programme launched the GSMA Innovation Fund. Six organisations received grant funding to scale digital agriculture solutions for smallholder farmers, including enterprise services for agribusinesses or cooperatives to digitise farmer profiles and procurement transactions, and B2C services for smallholder farmers, including digital advisory and financial services.[18] Each of these services are intended to increase farmer incomes and/or climate resilience because it is assumed that services designed to address farmer challenges, and tested to match their digital literacy, will lead to repeat and sustained usage.

10. Christiaensen, L. and Martin, W. (26 July 2018). "Five new insights on how agriculture can help reduce poverty". *World Bank Blogs*.
11. World Bank. (2018). ICT in Agriculture: Connecting Smallholders to Knowledge, Networks, and Institutions Updated Edition.
12. ReSAKSS. (2020). Annual Trends and Outlook Report. Chapter 13: The Enabling Environments for the Digitalization of African Agriculture.
13. World Bank. (2021). What's Cooking: Digital Transformation of the Agrifood System.
14. In agriculture, the last mile is the web of relationships and transactions between crop buyers and farmers who produce and sell their crops. In the last mile, global markets connect with rural economies before the processes of transformation and value addition take place.
15. GSMA. (2020). "Chapter 6: The business case for farmers to participate in digitised value chains". The GSMA AgriTech Toolkit for the Digitisation of Agricultural Value Chains.
16. Technical Centre for Agricultural and Rural Cooperation (CTA). (2021). The Digitalisation of African Agriculture Report, 2018–2019.
17. GSMA. (2020). The GSMA AgriTech Toolkit for the Digitisation of Agricultural Value Chains.
18. The GSMA originally signed grant agreements with seven organisations, six of which achieved all project milestones. The grant agreement with the seventh grantee, signed in June 2020, was terminated in January 2022 due to a shift in priorities during the COVID-19 pandemic that resulted in a failure to meet key project milestones.

Figure 2
Overview of digital services supported by the GSMA Innovation Fund

1. Digital profiles and procurement	Digital profiles create a digital record of the interactions between farmers and agribusinesses or cooperatives. At their most basic, digital procurement solutions generate digital transaction records, but a growing number of solutions integrate other sub-use cases, including digital payments, traceability or a combination of both.
2. Digital payments	Digital payments enable farmers to transact with various actors in the agricultural value chain, for instance, to make and receive payments, including electronic vouchers that can be used to redeem agricultural inputs. Digital payments also allow farmers to save money and develop a transaction history that can be combined with other types of data to access formal financial services.
3. Digital advisory	Digital advisory covers agricultural and livestock information, weather and climate information and information on market prices. Agricultural value-added services (VAS) are delivered via voice channels (IVR, helplines), text channels (SMS and USSD) and apps.
4. Weather forecasts and climate-smart advisory	These specialist services provide regional and localised weather forecasts. Climate-smart advisory includes weather-adaptive and climate-smart farming advice.
5. Loans	These lending products target smallholder farmers and address their specific agricultural needs. Most of these products enable the provision of short-term financing for agricultural inputs.
6. Insurance	Agricultural insurance services help smallholder farmers mitigate the risks associated with external shocks, such as weather events, pest and disease outbreaks. Agricultural insurance includes weather index, area yield index, multi-peril, livestock and livestock index insurance products.

Organisations supported by the GSMA Innovation Fund fall into two categories:

- **Mobile network operators (MNOs)** that, in partnerships with agritechs, develop, implement, launch and/or scale B2B2C enterprise services that leverage mobile money and airtime infrastructure to digitise procurement and communication with smallholder farmers in the agricultural last mile.

- **Agritechs** that have already scaled digital farmer profiles and procurement services and leverage this data to link farmer records with FSPs and provide additional services to farmers.

Figure 3

Organisations supported by the GSMA Innovation Fund

1 Nigeria

AGRO AgroMall

2 Sri Lanka

Dialog

3 Pakistan

Jazz

4 Indonesia

KOLTIVA

5 Rwanda

MTN

6 Tanzania

vodacom

Organisation supported	Summary profile	Services
1 **Type:** Agritech **Country:** Nigeria AGRO AgroMall AgroMall Discovery and Extension Services Limited	AgroMall is a Nigerian agritech founded in 2016. Their mission is to assist smallholder farmers and agribusinesses in digitising their profiles, transactions and payments. AgroMall also offers digital advisory services and access to financial services, primarily input loans. The company also offers logistics and storage solutions for agricultural produce.	
2 **Type:** MNO **Country:** Sri Lanka Dialog Dialog Axiata PLC	Dialog Axiata PLC is the largest MNO in Sri Lanka with 53% of total mobile connections, delivering mobile telephony and mobile internet services to a subscriber base of 17.9 million people. Dialog has long leveraged agritech services for the benefit of smallholder farmers, developing the Govi Mithuru agricultural advisory service in 2015 and later expanding into partnerships to offer digital procurement and insurance.	
3 **Type:** MNO **Country:** Pakistan Jazz Pakistan Mobile Communications Limited, "Jazz"	Jazz is the leading MNO in Pakistan with more than 75 million subscribers. Jazz first entered the agriculture sector in 2017 when they began offering the mobile agricultural advisory service BaKhabar Kissan (BKK), which translates as "Informed Farmer". Jazz partnered with agritechs BKK and Ricult to deliver a full range of digital agriculture services to agribusinesses and smallholder farmers.	
4 **Type:** Agritech **Country:** Indonesia KOLTIVA Koltiva AG	Established in 2013, Koltiva is a leading agritech that enables enterprises to make their global supply chains inclusive, climate smart and traceable. Koltiva combines triple tech (agritech, fintech and climatetech) to improve producers' outcomes and profitability while building more sustainable supply chains. Koltiva provides traceability systems from seed to table through KoltiTrace, an integrated multi-crop platform for all supply chain actors. FarmCloud is a mobile app for producers, FarmGate is for collectors and traders and FarmRetail is an e-commerce platform for agri-input shops and distributors.	
5 **Type:** MNO **Country:** Rwanda MTN MTN Rwandacell PLC	MTN is the leading MNO in Rwanda with 60% of all mobile connections. Having launched their mobile money service in 2009, MTN is now looking to digitise the agricultural ecosystem to increase mobile money usage and financial inclusion in the country. They have deployed a digital solution that allows agribusinesses to digitise procurement and payments to farmers. Agribusinesses can use the solution to digitally profile farmers and track real-time harvest activity through online dashboards. The service is available through an app for agribusinesses and a USSD channel is being developed.	
6 **Type:** MNO **Country:** Tanzania vodacom Vodacom Tanzania PLC	Vodacom is the largest MNO in Tanzania with 30% customer market share as of September 2022. Their mobile money service, M-Pesa, was introduced in 2008 and now has more than 15.6 million customers, representing 39% market share. Agriculture has long been a strategic priority for Vodacom, with ventures such as Mezzanine, a Vodacom-subsidiary technology company, and more recently M-Kulima, an enterprise solution that enables end-to-end B2B2C services that digitise procurement in the last mile.	

Digital profiles and procurement **Digital payments** **Digital advisory** **Loans** **Insurance**

Objectives of this report

As the GSMA Innovation Fund wrapped up in December 2022, the GSMA and partners reflected on the successes and challenges of digitisation in the agricultural last mile. This report provides a comprehensive overview of lessons learned from the GSMA Innovation Fund, based on data from June 2020 to October 2022. It analyses the various business models of the six grantees and pinpoints best practices and challenges in developing and scaling digital solutions in agriculture. It pays specific attention to the research, design and development of these services, including the user journeys and factors driving adoption and use among smallholder farmers. The report also assesses the impact of these services on farmer incomes, productivity, financial inclusion and climate resilience. Specifically, the report addresses the research questions highlighted in Figure 4.

Figure 4
Research questions addressed in this report

Usage	Business model
How have farmers been using the digital services piloted by grantees?	How did the grantees' business models evolve?
How have different user segments used grantee services?	What challenges did grantees face and how were they overcome?
What barriers emerged in the user journey and how were they addressed?	What are the key success factors when launching and scaling digital solutions in agricultural last mile?

Impact	
What impact have digitised value chains had on farmer livelihoods? How have different services helped to increase farmer incomes and climate resilience?	How have women farmers, youth and farmers with disabilities benefited from digital solutions? What are the best practices in designing inclusive digital solutions?

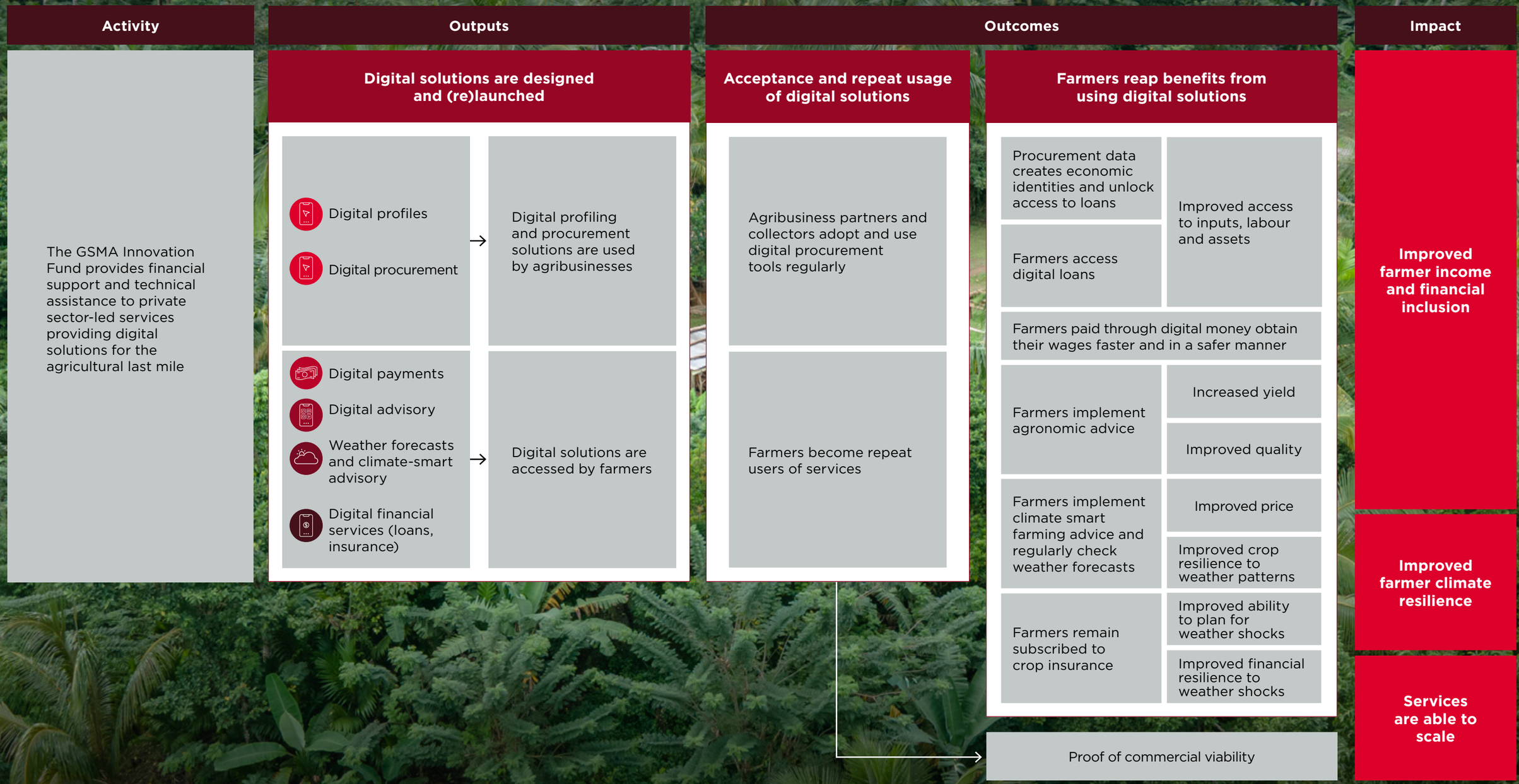
This report is aimed at agritechs, agribusinesses and technology providers that deploy digital agriculture solutions in the last mile. By sharing lessons in service design, user journeys and partnerships, it is hoped that the report will be a useful guide.

This report also aims to help NGOs, donors and impact investors identify the biggest contributors to increased farmer incomes, financial inclusion and climate resilience.

Methodology

The GSMA Innovation Fund uses a Theory of Change (ToC) to map the intended contribution of various digital agriculture services to the incomes and climate resilience of smallholder farmers (see Figure 5).

Figure 5
The GSMA Innovation Fund pathway to impact



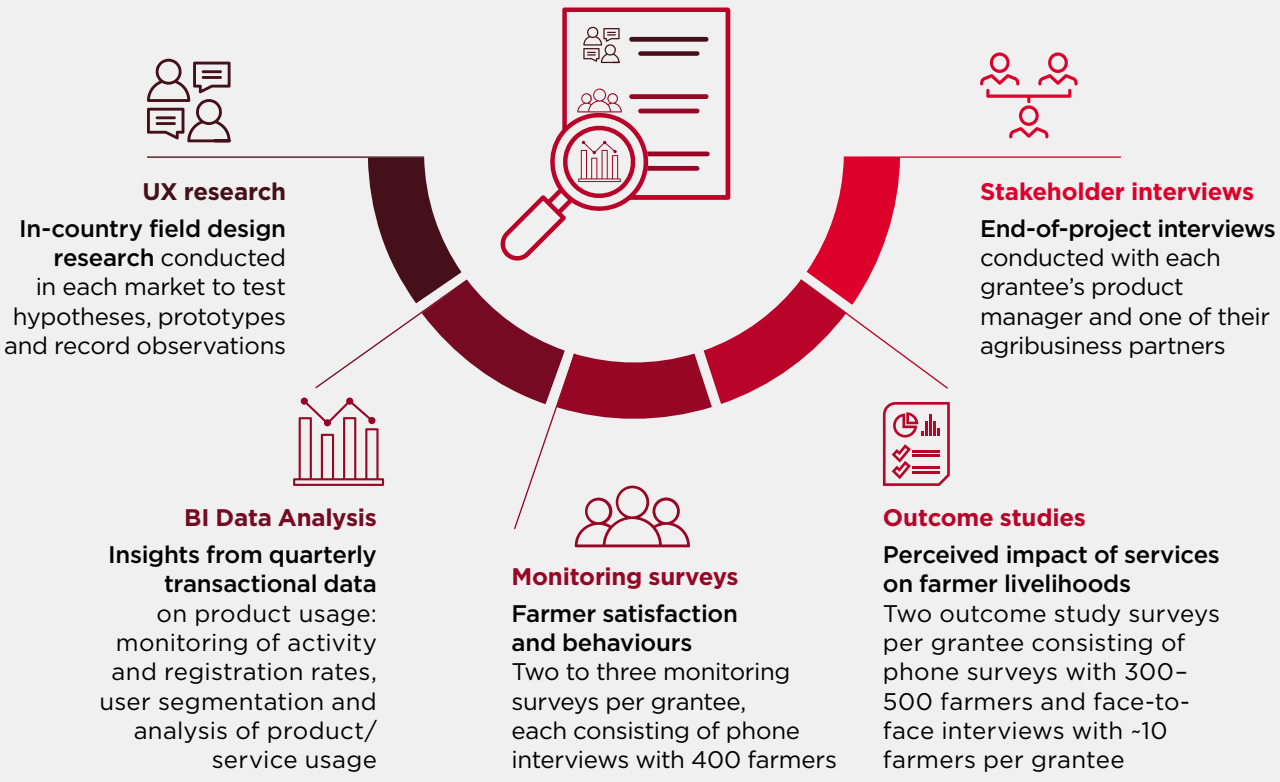
Quantitative and qualitative data were collected to support the ToC, including business intelligence and survey data collected throughout the grant. Monitoring surveys shed light on service uptake and usage, including user feedback on services, while outcome studies assess the perceived impact of services on farmer incomes and climate resilience. The report also draws on user experience (UX) research conducted during product development, as well as market engagement insights on how the services and business models have evolved. Finally, key stakeholder interviews with our six grantees and their consortium partners help us draw lessons from their experiences.

Business intelligence (BI) data on service adoption and usage includes data from 1,400,542 digitally profiled farmers and 513,580 service users. Monitoring surveys sampled 4,589 farmers while outcome studies reached a total sample of 3,638 farmers, including an additional 128 in-depth interviews with farmers.

Two to three monitoring surveys, as well as two outcome studies, were completed per grantee throughout the project. Due to COVID-19, service launches were delayed and resulted in small sample sizes and incomplete services for the first wave of monitoring surveys and outcome studies. As such, those surveys were primarily used to inform product iteration. This report presents the findings of the last wave of monitoring surveys (N=1,668 quantitative surveys respondents and 53 qualitative interviews). More details on the sample sizes of each dataset can be found in Annex 4.

The data sources supporting the results and lessons of the GSMA Innovation Fund will be mentioned throughout the report using the methodology outlined in Figure 6.

Figure 6
Methodology used for the report



2 Adoption and perceived impact of services supported by the GSMA Innovation Fund

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At the bottom of each page in Chapter 2 is a menu button that takes you back to this page where you can navigate to each section of Chapter 2.

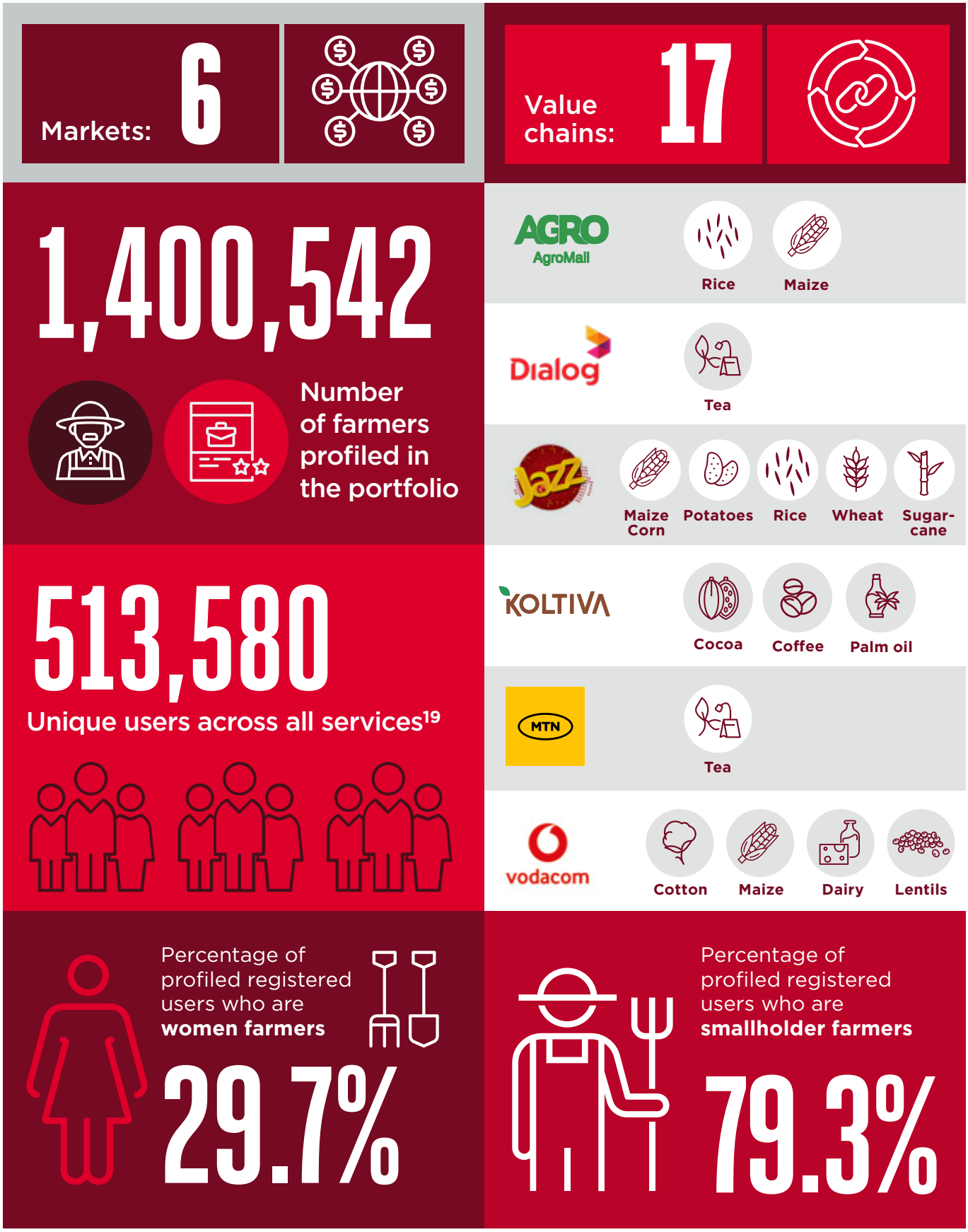
The first two parts of this chapter focus on service adoption rates and findings from service design (2.1 and 2.2). This section is for service providers, tech implementers and research organisations interested in learning what farmers thought about these digital services and their pain points along the user journey and with service design.

The third part of the chapter focuses on the perceived impact of these services on farmer incomes and climate resilience (2.3). This section is geared towards research organisations, NGOs, donors and impact investors who want to understand the extent to which digital agriculture services can improve smallholder farmer livelihoods.

2.1 Outreach of the GSMA Innovation Fund

The numbers in this section are based on data available at the time this report was published, from June 2020 to October 2022.

2.1.1 High-level outcomes of the GSMA Innovation Fund



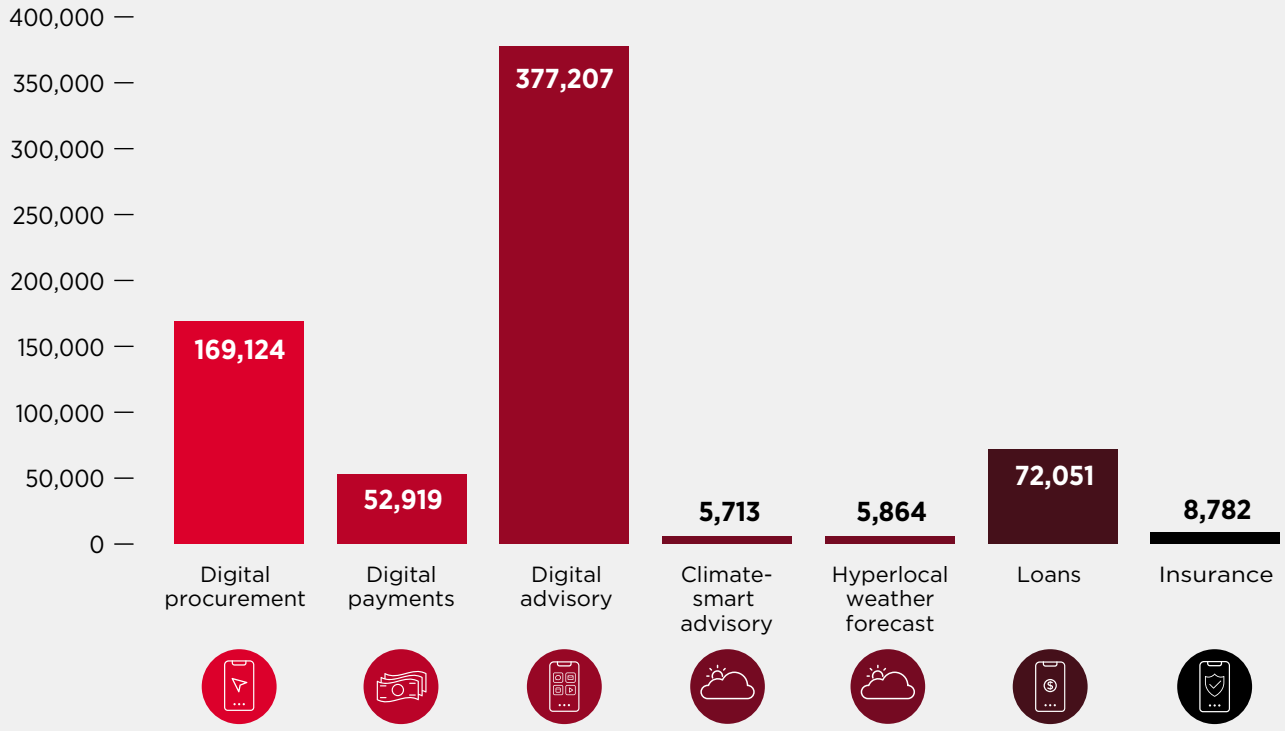
19. "Users" are defined as farmers who have accessed the service at least once (due to the seasonal variability in usage depending on the crop grown). "Digital advisory users" are defined as farmers who have received at least one SMS advisory message, opened their advisory app at least once or called a call centre at least once. "Loan users" are farmers who took out an in-kind input loan or used the Songesha overdraft service. "Procurement users" are defined as farmers who had their sale recorded digitally by an agent at least once.

Across the six Innovation Fund grantees, 1,400,542 farmers were digitally profiled, 79.3% of whom are classified as smallholder farmers cultivating farms less than 2 ha.[20]

BI Data

Figure 7

Number of farmers using services supported by the GSMA Innovation Fund[21]



Digital advisory services had the highest adoption rate of all digital agriculture solutions supported by the GSMA Innovation Fund. This is because digital advisory is a more established digital service in agricultural value chains and is often offered free to farmers or at very low rates. Push SMS-based advisory enjoys particularly high adoption since registration is bundled with digital profiling. Digital advisory services are also provided on a regular basis throughout the crop cycle, offering immediate and tangible benefits to farmers.

The number of digital procurement users reflects the number of farmers who chose to sell their produce to grantee agribusiness clients using digital procurement software. Although farmers may be registered on a digital platform, they can decide to sell to other buyers that are more convenient or offer better pricing. Farmers might also shift value chains to focus on more profitable crops or leave the farming sector altogether. Finally, the digital recording of transactions relies on agribusiness clients training their purchasing clerks and rolling out the solution to their collection centres. Together, this explains why only 12% of farmers who were digitally profiled had their sales digitally recorded.

Of the farmers who had their sales digitally recorded, more than 50,000 were paid through a digital channel. There is still a strong preference for cash among most farmers and ecosystem players (input sellers and retailers), which has stalled adoption of digital payments. Adoption was also hindered by transaction fees that farmers perceived as too high, as well as inefficiencies in the agent networks that cash out procurement payments.

Loan services were launched in the last half of the GSMA Innovation Fund and, therefore, have yet to scale. However, in markets where loans were launched (Nigeria, Tanzania, Indonesia and Pakistan), early trends show rapid uptake of loans, and feedback from farmers indicate that loans are considered an extremely valuable service.

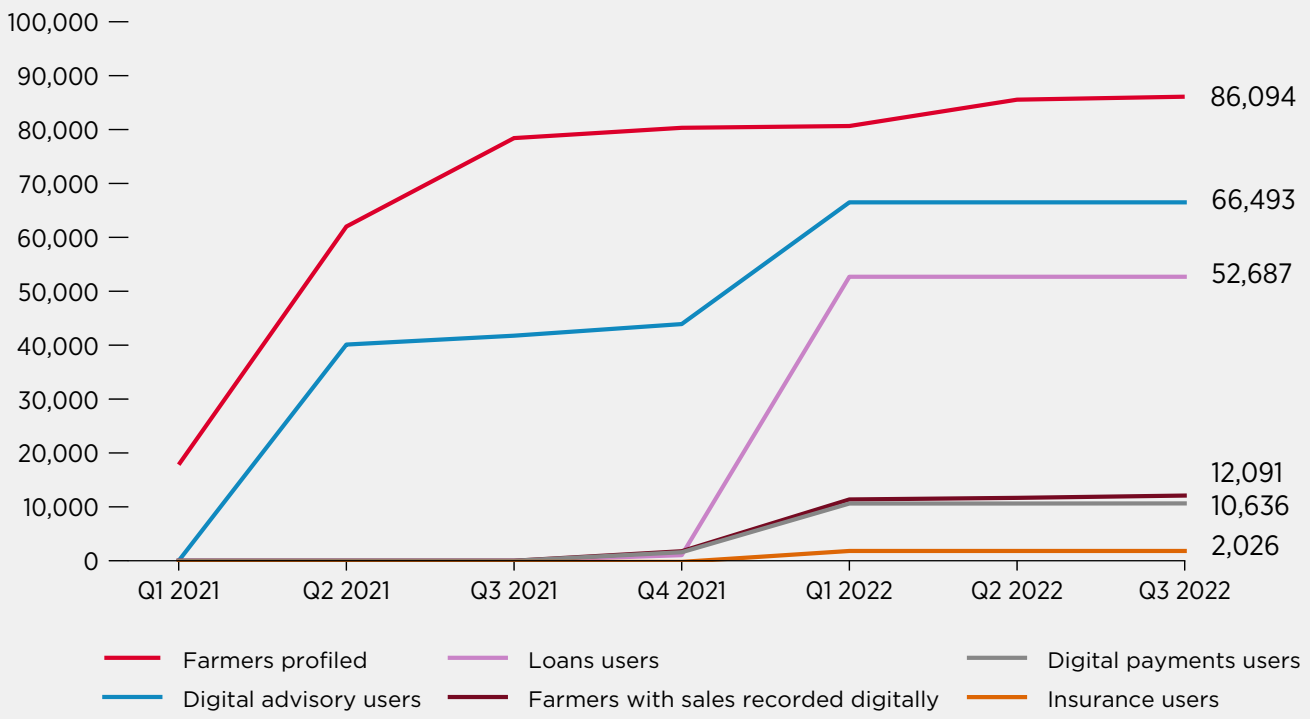
Services that support farmers' climate resilience (insurance, climate-smart advisory and hyperlocal weather forecasts) have been slow to take off among smallholder farmers, mainly due to low awareness and low willingness to pay.

20. Except for smallholder farmers in Pakistan who are defined as those cultivating a farm of less than 5 ha.
21. Number of farmers who accessed the service at least once (see definition of "user").

2.1.2 Service adoption per grantee

BI Data

Figure 8
AgroMall user base
(October 2022)



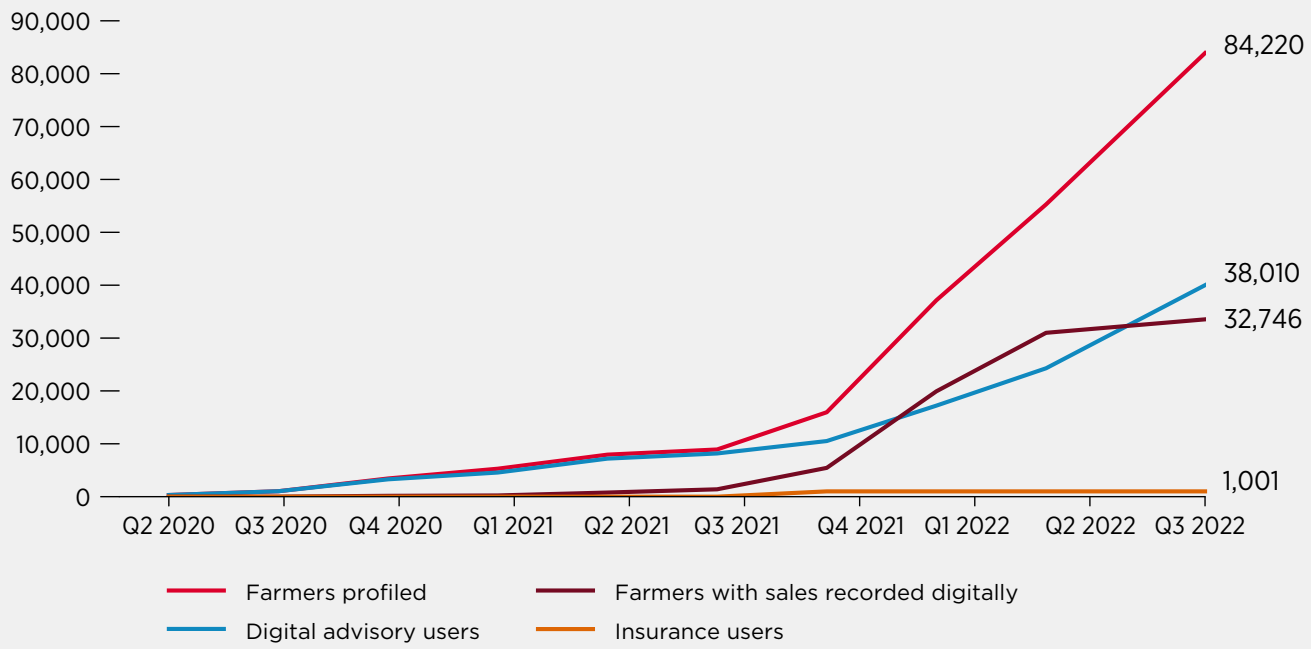
AgroMall's data illustrates the importance of seasonality in the provision of digital agriculture services to rice and maize farmers.

Rice and maize are mostly rain-fed in Nigeria and the optimal planting time is between mid-March and mid-April, explaining the increase in service adoption in Q1 2022.

By the end of the GSMA Innovation Fund, AgroMall had digitally profiled 86,094 rice and maize farmers. More than 75% registered to receive digital advisory services, making it the company's flagship VAS. AgroMall also recorded high uptake of their in-kind input loans, with more than 60% of their farmer base receiving one. Lending criteria for in-kind input loans were lower than for cash loans, which explains the high uptake. AgroMall also relied on their strong agent network to facilitate distribution of the in-kind input loans and on their commodity aggregation know-how and storage facilities, which allowed in-kind repayments from farmers.

BI Data

Figure 9
Dialog user base
(October 2022)



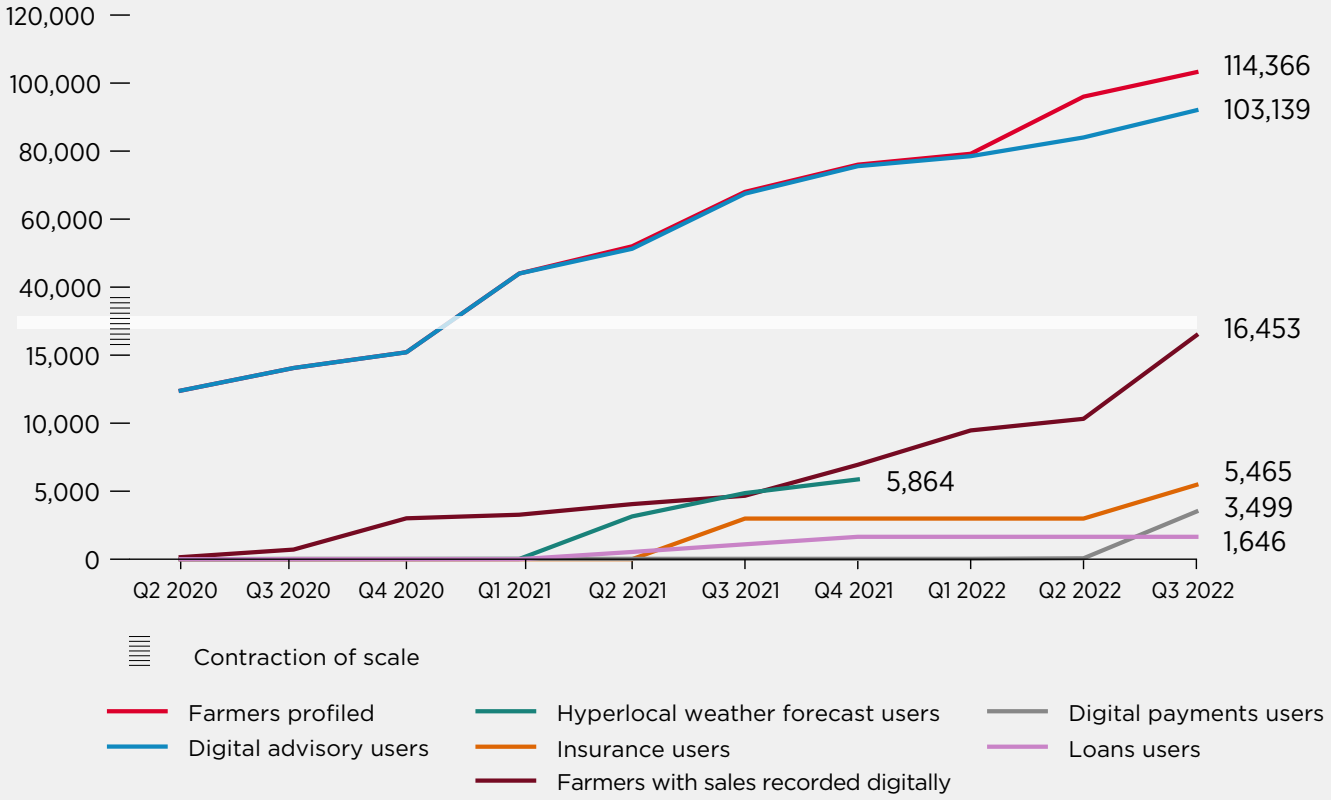
Since tea is cultivated throughout the year, adoption of Dialog's digital agriculture services has steadily increased.

The increase from Q4 2021 onwards corresponds with an increase in the number of factories partnering with Dialog, from one in Q4 2020 to 15 in Q3 2022. Profiled farmers correspond with digital advisory users and farmers who had their sales digitally recorded.

By the end of 2022, Dialog had digitally recorded 770,099 transactions from more than 15 tea factories in their digital procurement service. Dialog has also reached 33,274 registered tea farmers through their digital advisory service and just over 1,000 insurance users.

Figure 10
Jazz user base
(October 2022)

BI Data

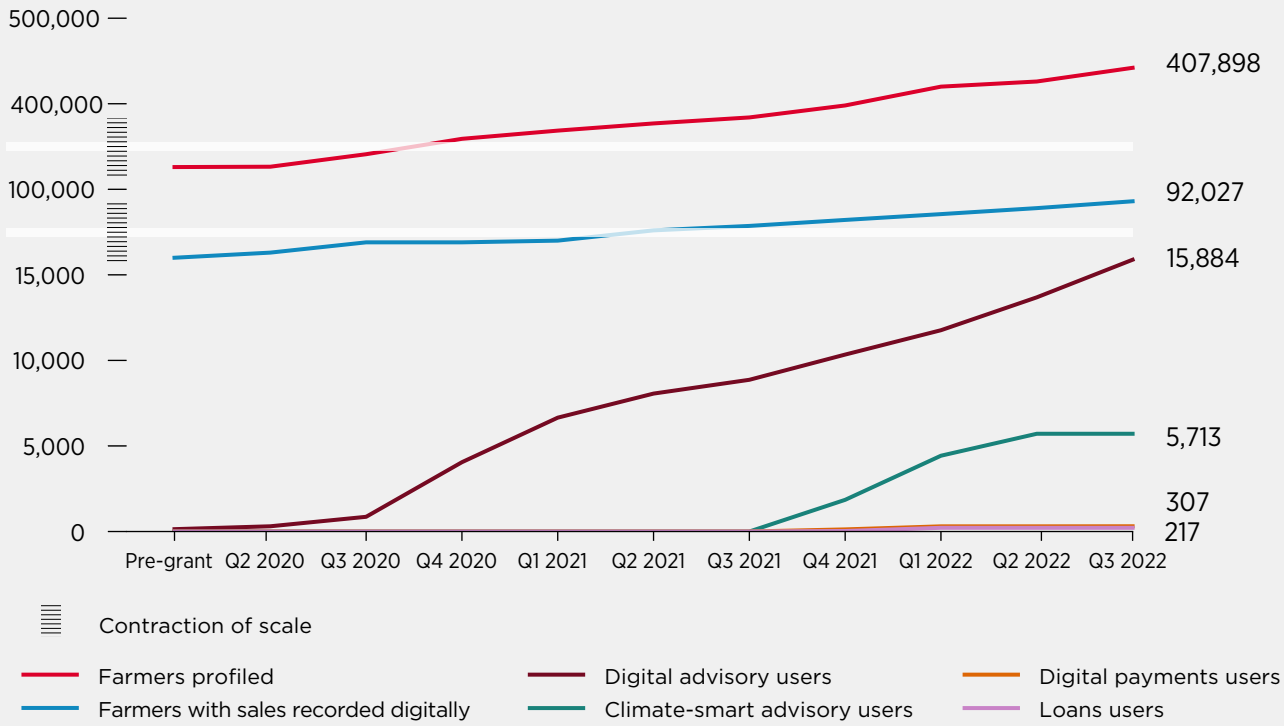


At the end of October 2022, 114,366 farmers were digitally profiled by Jazz partners, 16,453 of which had their sales recorded digitally.

All farmers profiled by Jazz partners received weather information from BKK up until 2022. Uptake of insurance by 5,465 farmers affiliated with Jazz Pakistan was based on the two insurance cycles at the start of the growing season, hence the annual peaks in August. Providers did not share updated data on hyperlocal weather forecast services after Q4 2021.

BI Data

Figure 11
Koltiva user base
(October 2022)

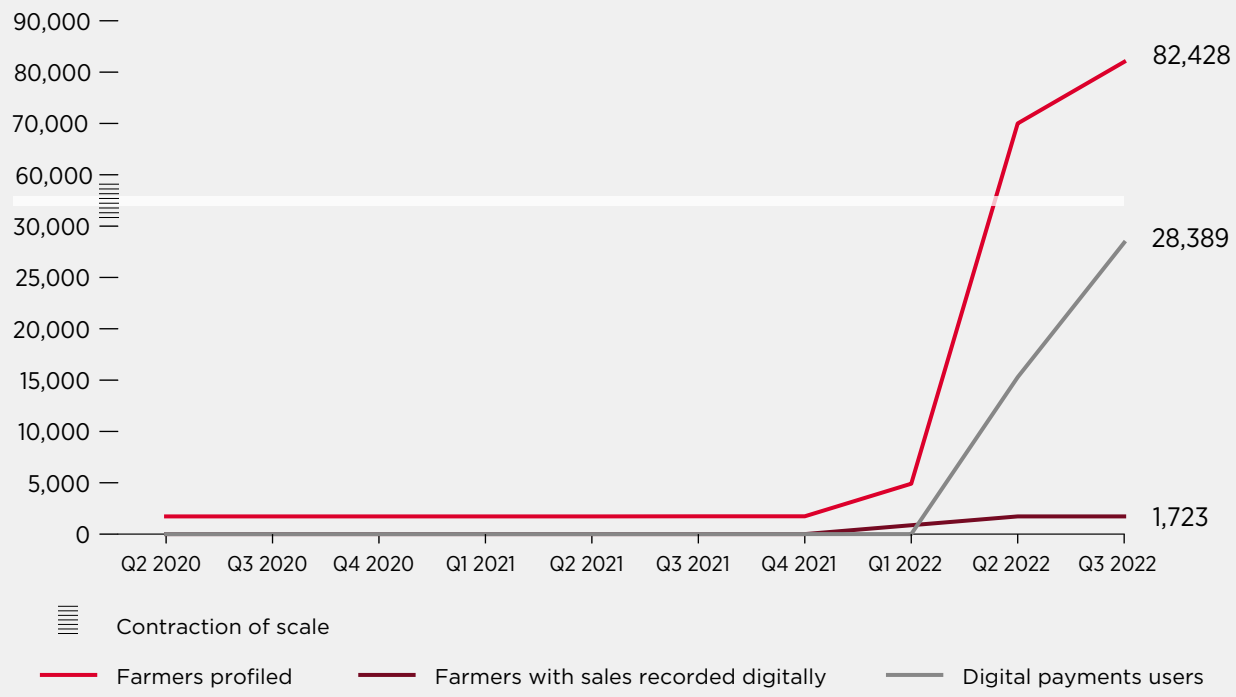


Koltiva agents digitally registered 407,898 farmer profiles, more than 300,000 of which were from their existing farmer base.

This explains why Koltiva started with a high number of digitally profiled farmers. Since the start of the grant in Q2 2020, growth in new farmers profiled has been slow but steady: 96,027 farmers had their sales digitally recorded by five agribusinesses and Koltiva has onboarded more than 3,000 traders and agri-input shops on their app.

Figure 12
MTN user base
(October 2022)

BI Data

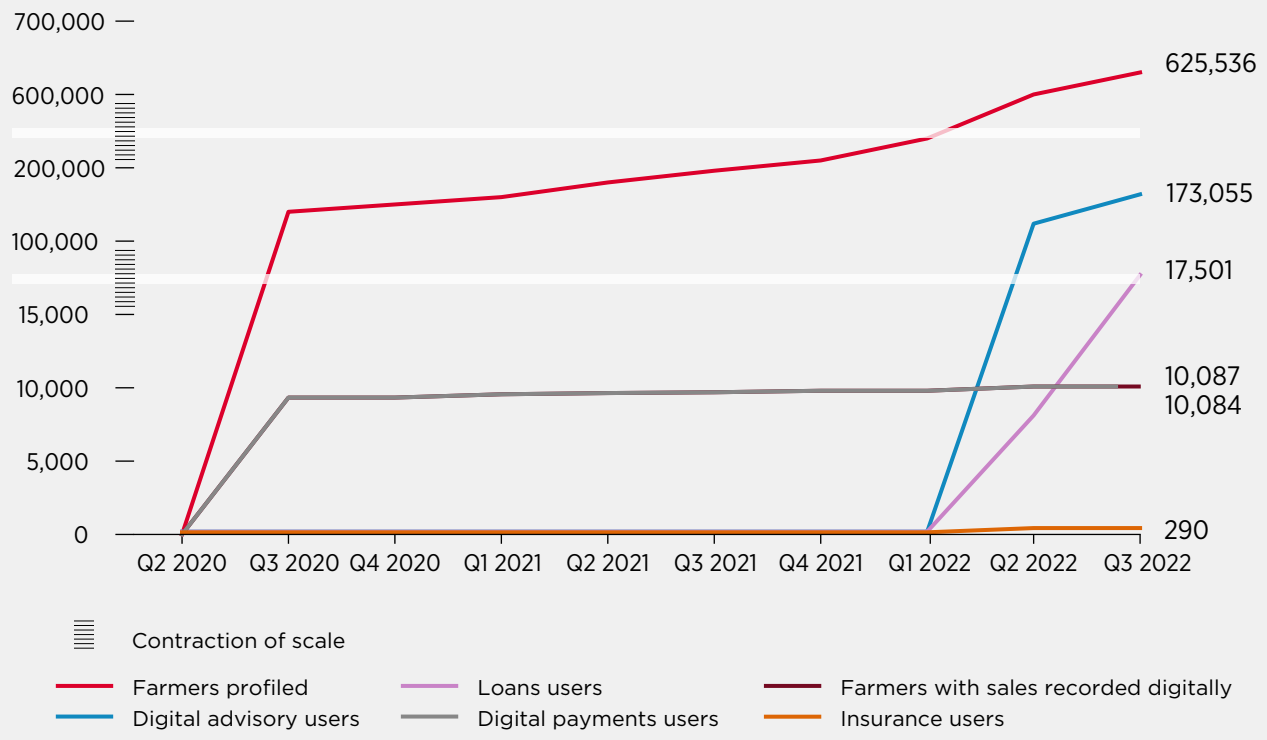


MTN piloted farmer digital profiles in early 2020, but only expanded the pilot after developing a procurement service and integrating their MoMo payment service in early 2022.

This explains the pause in farmer profiling before Q1 2022. Digital procurement was not an entry point to using digital payments, as agribusiness partners were already paying farmers through MoMo before the digitisation project. By the end of the grant, MTN had a user base of 82,428 digitally profiled farmers, 1,723 of whom had their sales digitally recorded and 28,389 had been paid digitally.

BI Data

Figure 13
Vodacom user base
(October 2022)



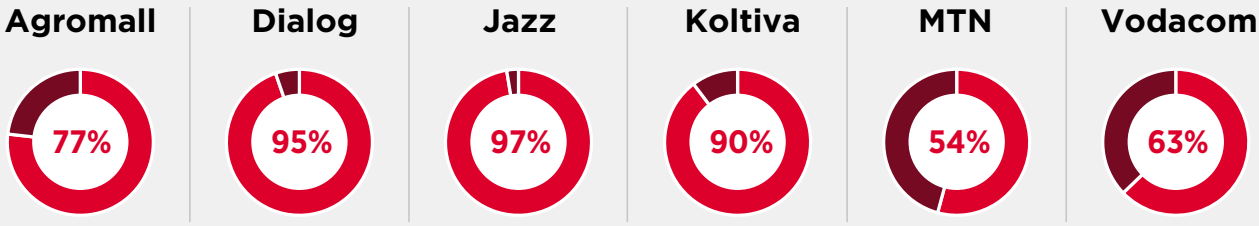
Vodacom recorded 625,536 farmer profiles, which accounted for 45% of profiles created during the grant period.

Vodacom reached this scale by leveraging a government-led fertiliser subsidy programme that made it mandatory for farmers to be biometrically registered to receive fertiliser. The introduction of a self-registration model also helped increase registrations by allowing farmers to create their own profiles and register for VAS through a USSD system. By the end of the GSMA Innovation Fund, 10,084 farmers had their sales recorded digitally and 10,087 had received digital payments. Adoption stalled for both procurement and payments after the introduction of a government levy on mobile money transactions in July 2021. By October 2022, a total of 17,501 farmers had received a Songesha loan and 290 farmers had purchased insurance.

2.1.3 Farmer digital profiles by type of landholding

BI Data

Figure 14
Percentage of profiled farmers that are smallholder farmers



Across the six GSMA Innovation Fund grantees, 79.3% of profiled farmers were smallholders.[22] Although the types of farmers profiled vary by grantee, smallholder farmers represent the vast majority in GSMA Innovation Fund projects. There was a higher proportion of smallholder farmers among grantees in Asia (Dialog, Jazz and Koltiva) than in Africa (AgroMall, MTN and Vodacom), particularly in Pakistan (97%). Vodacom had a lower percentage of smallholders in their registration base than other grantees, which could be because their self-registration model made it easy for farmers to inflate their landholding or it attracted larger farmers from beyond their agribusiness partners. Meanwhile, MTN's agribusiness clients procure tea from both smallholder farmers and larger tea estates.

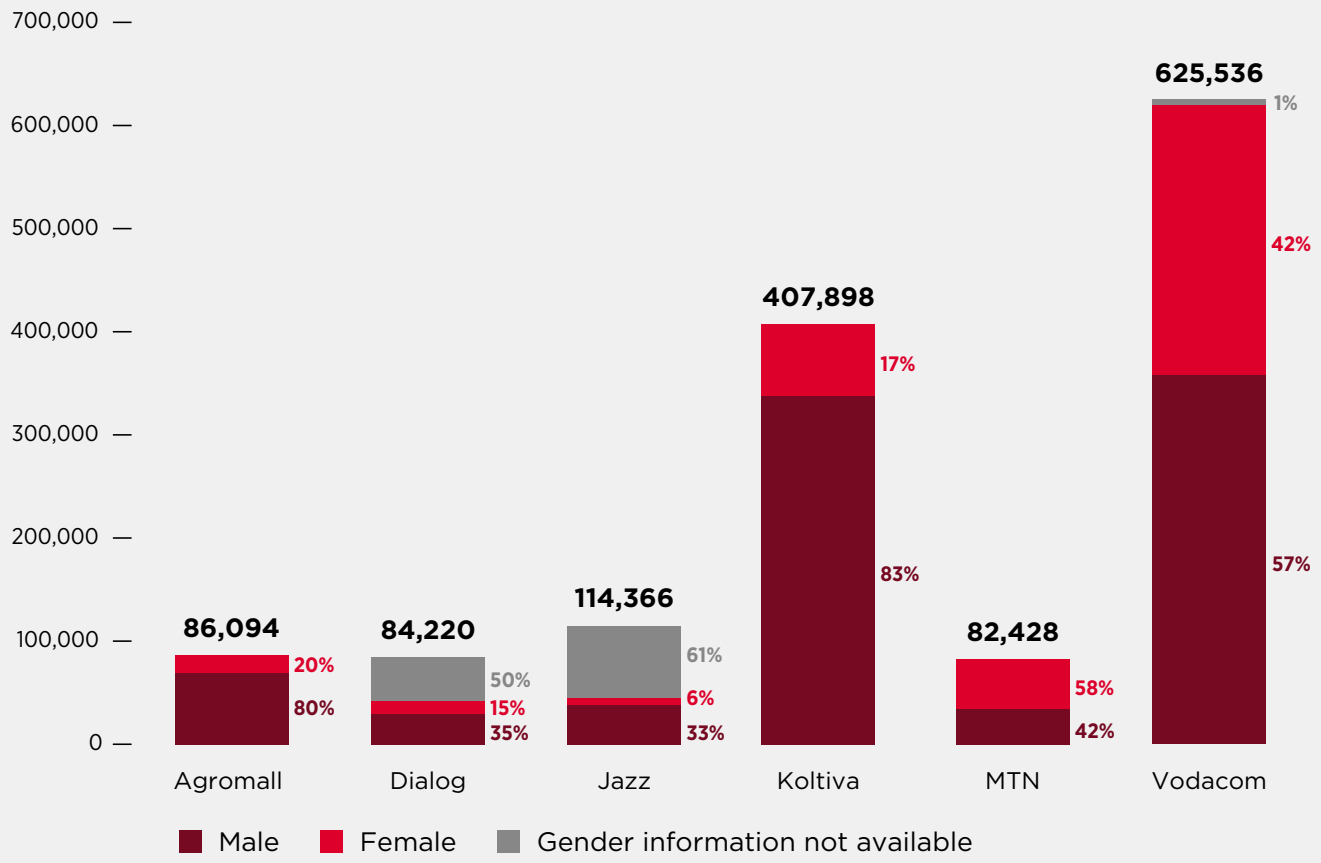
Since smallholder farmers face more challenges accessing markets, information and financial services than larger commercial farmers, being digitally profiled is disproportionately more impactful for smallholders as it unlocks access to essential services, often for the first time.

22. Smallholders are defined as farmers who cultivate up to 2 ha of land, with the exception of Pakistan where farmers who cultivate up to 5 ha are included based on the government definition.

2.1.4 Service adoption by gender

BI Data

Figure 15
Number of farmers profiled, by gender



Gender-disaggregated data was recorded for 91% of the farmers profiled by all six grantees. Registration to digital advisory services that were not bundled with digital profiles and procurement account for the missing gender-disaggregated data for Dialog and Jazz. **In total, nearly a third (29.7%) of profiled farmers are women, compared to 62% who are men.**[23]

Most agricultural value chains in the GSMA Innovation Fund portfolio are male dominated. This is especially true for cash crops, with the exception of tea in Rwanda and Sri Lanka. The number of digitally profiled women farmers reflects the gender imbalances present in these value chains before digital services were introduced. It also echoes data from the Technical Centre for Agricultural and Rural Cooperation (CTA), which found that women farmers represent only 25% of registered users of digital agriculture solutions.[24] Gender roles in agriculture are strongly influenced by social norms, which often preclude women from participating in certain formal agricultural value chains. Since men are typically the heads of households and landowners, they have formal relationships with crop buyers, such as agribusinesses and cooperatives. While women actively participate in activities such as sowing, weeding and harvesting, they are much less likely to sell produce to buyers.[25]

> "Women farmers work the big part on the farm, but it is the male farmers, our husbands, who come and benefit in the end. The challenge that women farmers experience is the ability to own land. The husband has the rightful ownership and can do anything with it. Whatever is produced out of these farms the man has full control over it."
>
> **Tanzanian farmer, female, 42 years old**

23. Gender inclusion was not an explicit focus of the GSMA Innovation Fund. The findings on women farmers' livelihoods and service adoption provide lessons throughout the report on steps to make services more inclusive.
24. Technical Centre for Agricultural and Rural Cooperation (CTA). (2021). The Digitalisation of African Agriculture Report, 2018–2019.
25. GSMA. (2022). Reaching and Empowering Women with Digital Solutions in the Agricultural Last Mile.

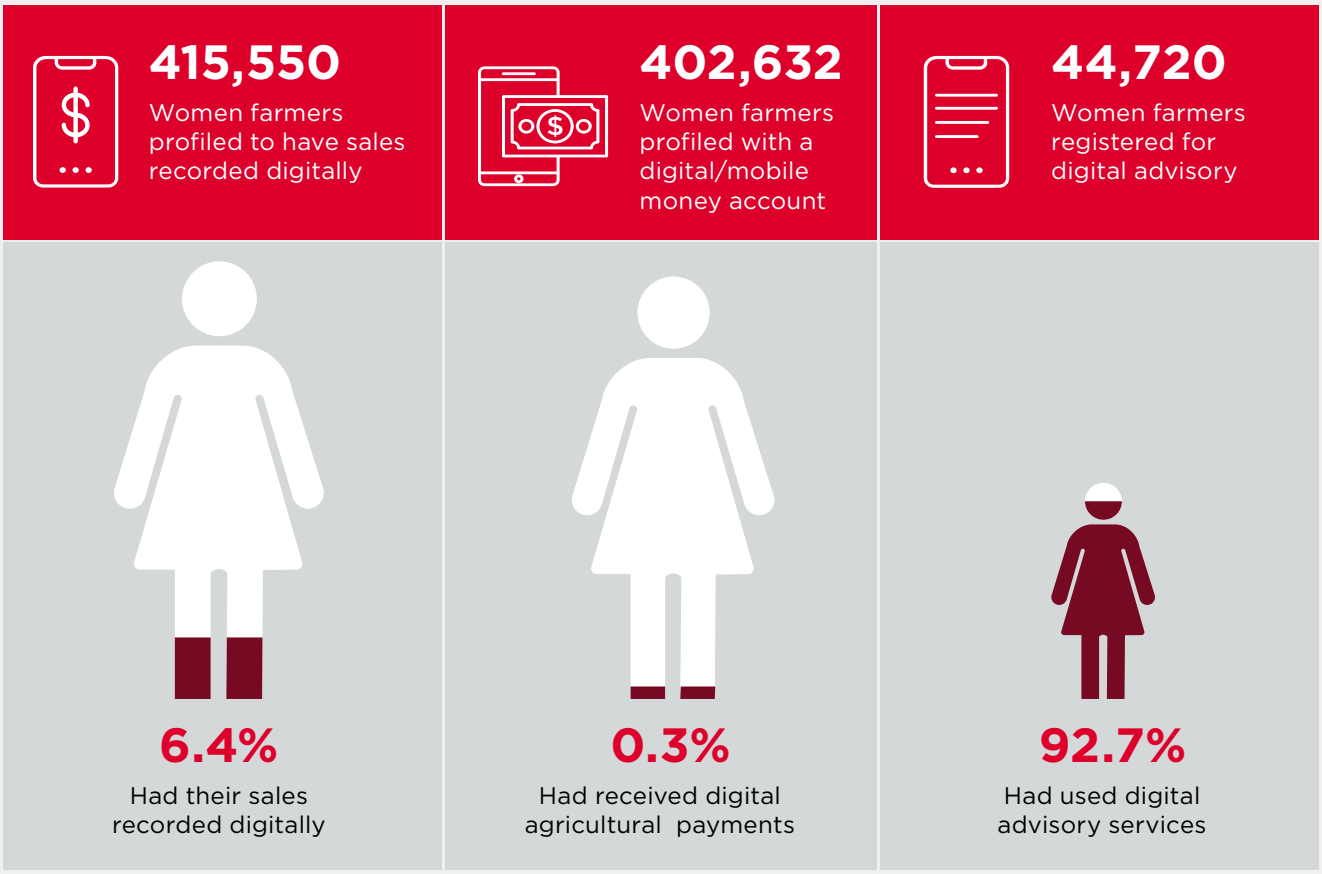
"Generally, lands are given to sons. Daughters are considered to be going away from home after marriage and therefore many immovable assets are not given to them."

Sri Lankan tea farmer, female, 47 years old

Vodacom was able to reach a much higher proportion of women when they expanded their potential customer base beyond farmers who were registered with agribusiness clients as landowners and selling produce. This outreach was achieved in partnership with a government-led fertiliser subsidy programme, which targeted a larger share of women than just the female farmers involved in selling cotton to Vodacom's agribusiness client.

BI Data

Figure 16
Number of women farmers who accessed the service at least once, out of the number of women farmers registered for the service[26]



Digital advisory has a high usage rate among registered women farmers, predominantly SMS and IVR-based advisory, which are better suited to users with lower levels of smartphone ownership and lower digital skills. Across the GSMA Innovation Fund portfolio, 92.7% of women farmers used advisory services at least once since registering for the service. This indicates that digital advisory services are a key gateway to reach women farmers.

Of the 415,553 women farmers who registered to use digital procurement with a grantee, 6.4% had at least one sale recorded digitally. Dialog in Sri Lanka and Koltiva in Indonesia recorded the highest usage, with 67.6% and 23.2% of registered female farmers having their sales recorded digitally, respectively. The high number in Sri Lanka is due to higher participation of women in the tea value chain compared to other countries.

Meanwhile, very few digital payments were made to female farmers – just 0.34% of female farmers profiled with a digital/mobile money account had received one. These low numbers reflect gendered roles in farming activities (women are less likely to be involved in selling their harvest to agribusinesses) and the digital payment gender gap (see section on digital payment adoption for more details).

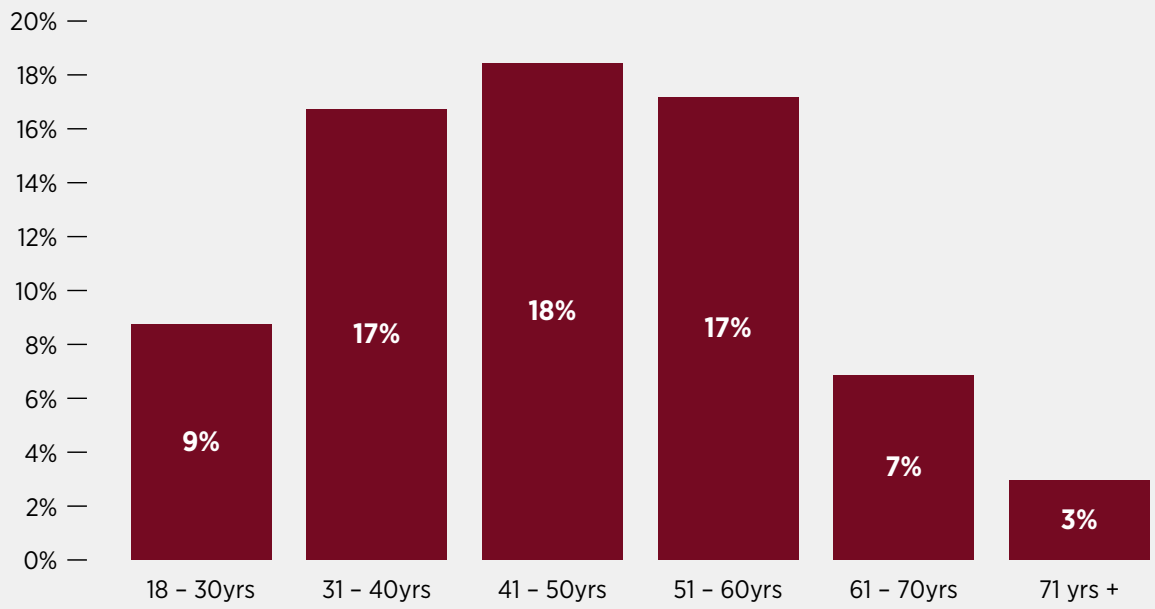
26 Loans were excluded from the analysis as no farmer, male or female, was rejected for a loan request, making all farmers who requested a loan active users of the service.

2.1.5 Service adoption by age

Three of the six grantees recorded sufficient data on age from farmer profiles. Together they represent 71% of the total number of farmers. Almost half (46%) of farmers profiled by Innovation Fund grantees are over the age of 40 while only 9% are under 30. Farmer profiles came mainly from an existing pool of farmers who sold to agribusinesses and cooperatives working with grantees, and the age disaggregation mostly reflects the age range of this farmer base. This is because the primary objective of the GSMA Innovation Fund was to convert existing relationships between agribusinesses and farmers from paper to digital, rather than target a different demographic of farmer or support agribusinesses to attract new farmers.

BI Data

Figure 17
Farmers profiled by GSMA Innovation Fund grantees, by age



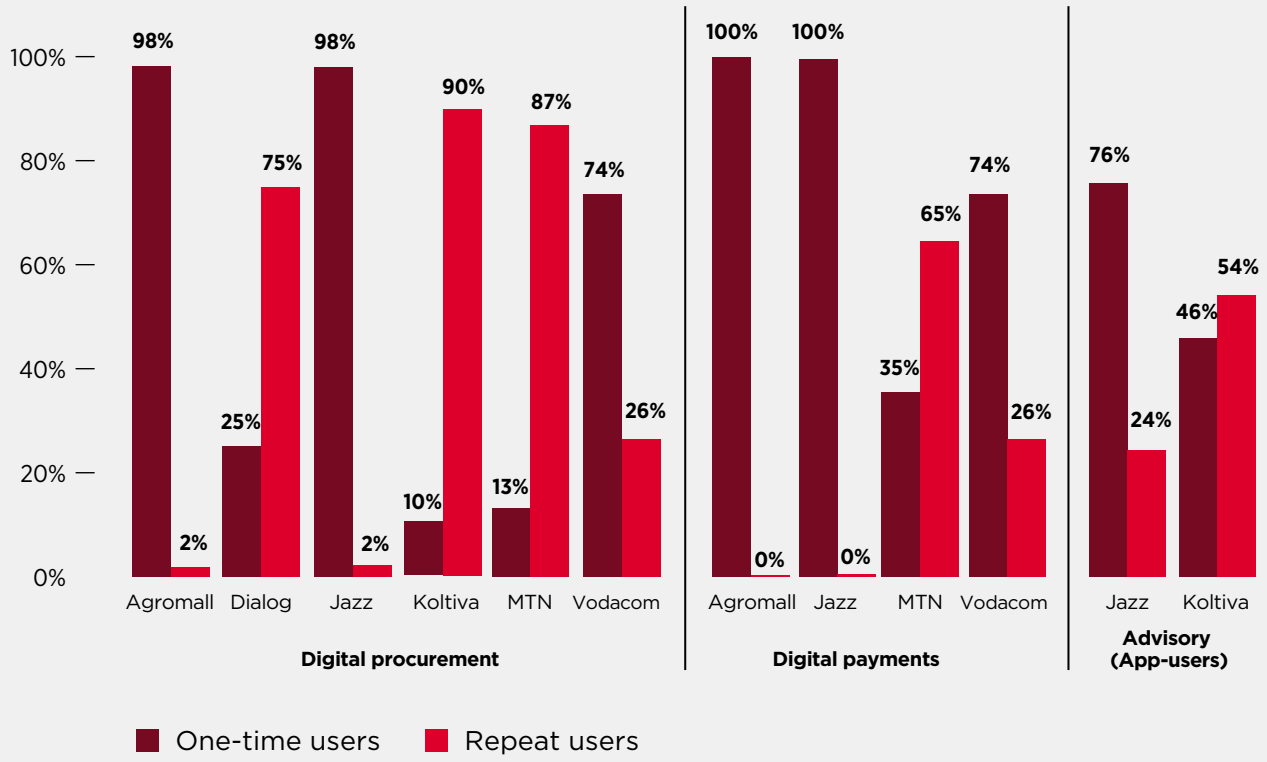
The low proportion of young farmers being profiled might be due to the land ownership requirement to join a cooperative or sell to an agribusiness, and it reflects the ageing demographic of the agricultural sector. In these markets, land is primarily owned by heads of households who are more likely to be older. Young people are also increasingly leaving rural areas to find better jobs in cities. Koltiva has the largest proportion of older farmers, with 77% over the age of 40. This reflects the age range of the agriculture sector in Indonesia, which has seen a steep decline in the number of young farmers in the past 20 years, down to 13% in the 2013 agricultural census.[27]

27 The Diplomat. (12 July 2018). Indonesia's Aging Farmers.

2.1.6 Service activity rates

BI Data

Figure 18
Percentage of one-time users versus repeat users, by service



Repeat usage[28] of digital procurement services and digital payments is highly dependent on the type of value chain and number of times a year a farmer harvests and sells a crop. Farmers who grow crops that are harvested continuously, such as tea and cocoa, sell their produce multiple times a year, which explains the higher rate of repeat usage for Dialog's, MTN's and Koltiva's digital procurement services. For service providers, digital procurement provides a higher return for crops with multiple annual harvests. For agribusinesses and cooperatives using procurement solutions, it provides a better chance to build farmer loyalty as they use the service more frequently.

Fewer women conduct sales transactions and, therefore, are underrepresented among digital procurement users. However, women who engage in selling have a higher likelihood of being repeat users – 87% of women are repeat users compared to 76% of men. There is an opportunity for agribusinesses to further explore the reasons for higher repeat usage among women, which may be due to greater loyalty to buyers or continuous involvement in farming activities over time.

Digital advisory activity rates vary depending on the channel. Converting users to repeat users is a key challenge for digital advisory apps since usage is at the farmer's leisure whereas with push advisory, farmers passively receive information. Sending new content notifications and marketing can increase the number of repeat users, as Koltiva found when they launched SMS marketing and notifications of new app content.

28. "Repeat usage" is defined as farmers who have accessed a service more than once.

2.2 Business models, service design and adoption: key findings

2.2.1 Registration and onboarding

Registration models

The first touchpoints for farmers using digital services are registration and onboarding. Across use cases, grantees used two registration models: agent-led registration and self-registration (Table 1).

Table 1
Registration models for digital services supported by the GSMA Innovation Fund

	 Farmer profiling and procurement	 Digital payments	 Digital advisory, including climate-smart advisory	 Weather forecasts	 Loans	 Insurance
Agent-led registration	— AgroMall — Dialog — Jazz — Koltiva — MTN — Vodacom	— AgroMall — Jazz — Koltiva	— Jazz	— AgroMall — Jazz	— AgroMall — Jazz — Koltiva	— Dialog — Jazz — Vodacom
Self-registration	— Vodacom	— MTN — Vodacom	— Dialog — Jazz — Koltiva — Vodacom	— Jazz — Koltiva — Vodacom	— Vodacom	

Agent-led registration models

Agent-led registration models rely on physical touchpoints in the last mile, either field officers from agribusinesses or agents from agritechs or MNOs, to raise awareness of digital services and activate farmers for registration and onboarding. The registration process is therefore led by agents, not farmers.

Agent-led models help to establish relationships between farmers and service providers, raise awareness of services, explain the value proposition and build trust. For example, AgroMall agents reach out to farmers and discuss the advantages of digital procurement with them one on one. Several grantees have also used the "circle of influence" method to gain the trust of farmers. For example, Vodacom used a "champion" model whereby individuals promoted digital profiling in their village and received a commission when farmers registered for the service. Vodacom also hired a team of 15 brand ambassadors to support farmer activation, travelling in trucks during the harvest season to hand out pamphlets and playing advertising jingles from loudspeakers.

Agent-led models are better suited to services that require highly accurate data and/or share data with a third-party FSP, such as procurement, loans or insurance. However, agent-led registration and onboarding are time-consuming and costly, which is why they are mostly undertaken by agritechs rather than MNOs, which do not have established agent networks dedicated to farmers. Vodacom is considering outsourcing farmer profiling to an agritech that can ensure clean, high-quality data, as this would free up time and resources to focus on the quality of service delivery and go-to-market strategies that increase adoption.

Self-registration models

Self-registration models use digital interfaces that farmers use to register on their own without the assistance of third parties.

Self-registration is most effective and well suited to services that have a simple registration interface, like Jazz's advisory services or Vodacom's M-Kulima loans and advisory services. Self-registration works well with digital advisory since the quality of input data is not as important as with other services, such as loans or insurance. However, for self-registration to scale, considerable resources need to be deployed in a mixed-marketing strategy that combines above-the-line and below-the-line campaigns, such as radio, vans, market demos and jingles. For smallholder farmers, self-registration scales better through USSD or IVR-led registration than mobile apps since most farmers still own basic feature phones. M-Kulima in Tanzania and Govi Mithuru in Sri Lanka both use this approach.

Considerations for registration models

Table 2
Pros and cons of agent-led and self-registration models

	Agent-led registration models	Self-registration models
Pros	— Agents can run quality checks on user data and there is a lower risk of inaccurate data entry — Agent registration can provide a strong first touchpoint with farmers, establishing the service brand and building trust — Farmers with low digital literacy can receive support from agents to register and ask questions about the service — Agents can demonstrate how the service works	— Cheaper than the agent-led model — Registrations can scale quickly without being limited geographically by the agent network
Cons	— It is costly as agents need to be hired and trained to properly represent the brand and deliver the value proposition to farmers — It is time-consuming and slows the pace of scale — Incentives for agent performance can lead to registering farmers with little interest in the service and high numbers of ghost users	— Requires strong media and activation campaigns and a simple registration interface — No quality assurance of user data at registration

For both registration models, the amount of information captured needs to be balanced. Too much information can make the registration process cumbersome and risks slowing down adoption. On the other hand, too little information risks reducing the impact of a service as information gaps would hamper the operation of services (e.g., making loan acceptance levels too low).

2.2.2 Service adoption and usage

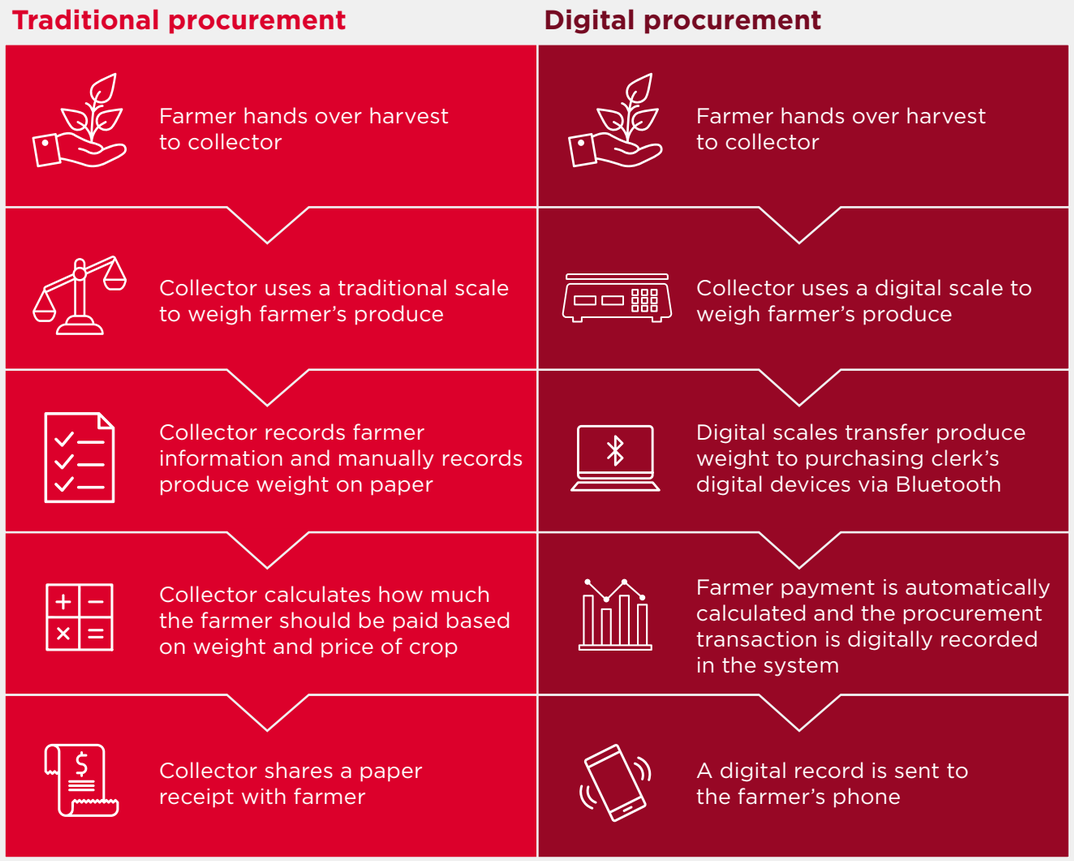
Once farmers are registered and onboarded, they can start using services. This section looks at adoption and use of the digital agriculture services provided by grantees and describes high-level outcomes for agribusinesses, cooperatives and grantees.

Digital procurement

Farmers who were digitally profiled on procurement databases can have their sales digitally recorded by purchasing clerks. In some instances, agents issue farmers procurement identification cards that need to be tapped on a digital scale or near-field communication (NFC) device. When farmers sell their produce at an agribusiness or cooperative, their produce is weighed on a digital scale and the amount due to the farmer is calculated automatically before the procurement transaction is recorded digitally in the system.

Depending on the value chain and agribusiness clients, quality parameters can be introduced during the weighing process to determine the price farmers receive. Purchasing clerks can then issue farmers a printed paper or SMS receipt. Digital procurement processes help to reduce data recording errors and remove the risk of purchasing clerks taking advantage of farmers. Since digital procurement systems are enterprise solutions, farmers' interactions with the service are limited to purchasing clerks weighing their produce digitally and issuing them a receipt for the transaction.

Figure 19
Traditional versus digital procurement processes



Traditional procurement

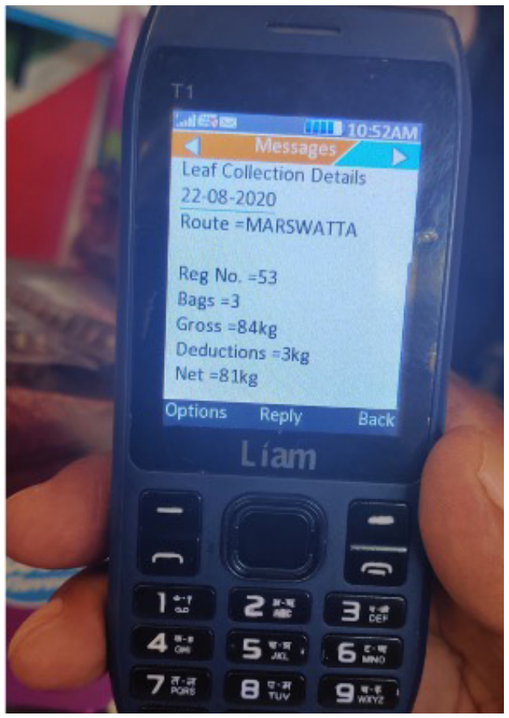
A traditional scale for tea procurement in Sri Lanka

A Sri Lankan farmer showing their manual records of tea leaves supplied to a factory

Digital procurement

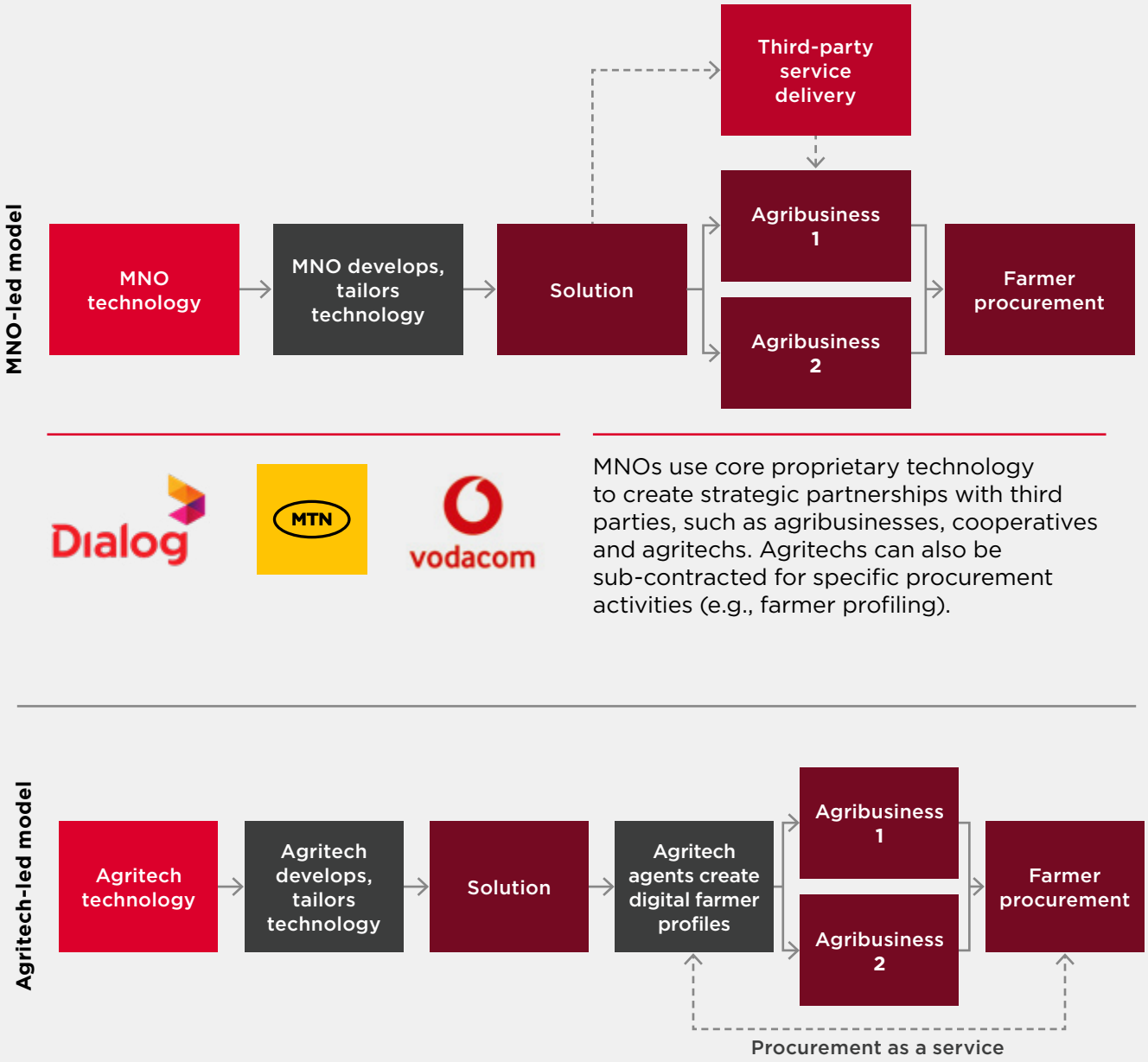
Collection agent weighing tea leaves with digital scales in Sri Lanka

SMS received on a Sri Lankan farmer's phone



Two digital procurement models were used by GSMA Innovation Fund grantees: the MNO-led model and the agritech-led model (see Figure 20).

Figure 20
Digital procurement models deployed by GSMA Innovation Fund grantees



Source: Adapted from the GSMA AgriTech Toolkit for the Digitisation of Agricultural Value Chains.

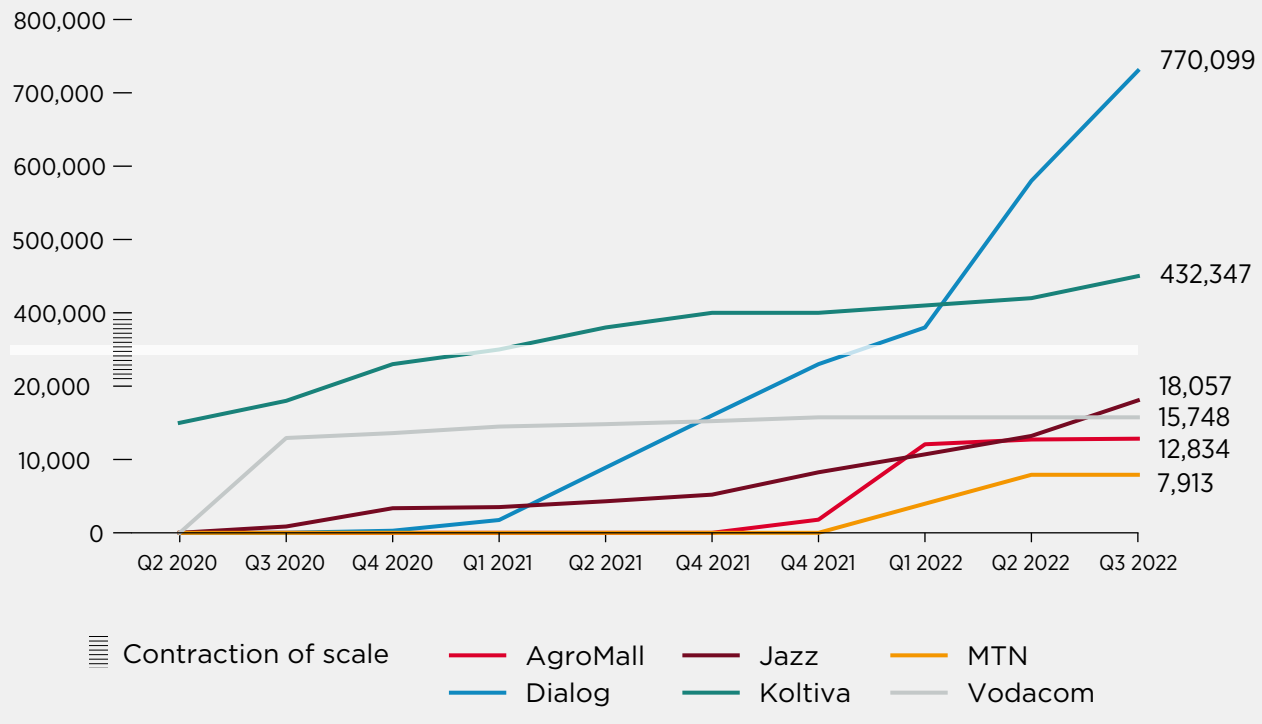
Digital procurement adoption

Of the six grantees, Dialog and Koltiva led digital procurement, recording more than 1.2 million digital transactions combined, while other grantees have had fewer than 20,000 transactions each. MTN has been slow to roll out digital procurement solutions, which explains why there were no procurement transactions between June 2020 and December 2021. In Tanzania, collectors stopped recording procurement transactions with the USSD solution in 2022 following the government levy on mobile money, as farmers preferred cash over mobile money payments to avoid the associated fees. Limitations with Vodacom's M-Kulima digital profile service also contributed to the low number of transactions in Tanzania, which agribusinesses reported could be too generic and did not allow field mapping. The agribusiness client Alliance Ginneries, for example, continued to use their own software for farmer profiling, which they consider more tailored and allows them to record farm and farmer data beyond yield estimates. They can also record attendance at farmer trainings, which is not possible on the M-Kulima system.

Most MNO grantees experienced the challenge of balancing service features with meeting the nuanced needs of different value chains. Agritech grantees whose business models have historically focused on procurement have specialised in highly tailored procurement solutions. For example, Koltiva operates across multiple value chains and iterates their core software to meet the needs of agribusiness for traceability, produce grading and climate-smart supply chains.

Figure 21
Number of digital procurement transactions, by grantee

BI Data



There is a low rate of farmers who have been digitally profiled and had their sales recorded digitally. Of all the farmers profiled, only 12% had their sales recorded digitally. Reasons for low conversion rates can vary depending on the context. In markets where crop procurement is not regulated and farmers can sell to any buyer (Nigeria, Sri Lanka and Pakistan), the gap between farmers who were digitally profiled and those who had their sales recorded digitally can indicate that digital procurement does not address the farmer loyalty challenges agribusinesses face when farmers regularly change buyers based on convenience or prices. Another possible explanation is that farmers who are profiled during a harvest season might shift to another crop for the next season or leave agriculture completely, creating ghost farmer profiles.

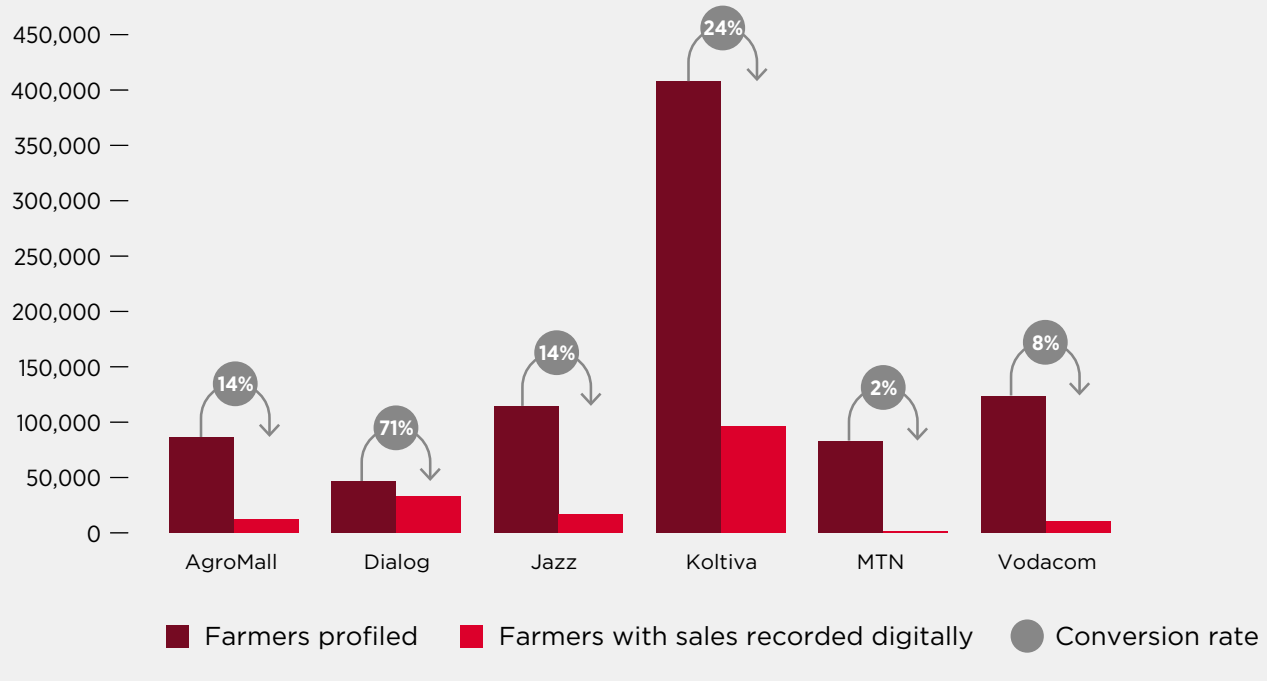
The older a farmer profile database, the more likely it is to contain outdated information or "ghost" farmers who moved away from the value chain or out of agriculture altogether. This was particularly the case in Indonesia where a high percentage of the Koltiva farmer profiles date back to 2017. Despite Koltiva's efforts to update producers' data through "boots-on-the-ground" extension officers, the prevalence of outdated information may contribute to the low conversion rate.

In Tanzania, Vodacom shifted to a self-profiling model through USSD, which expanded the pool of farmer profiles beyond those who use the digital procurement solution to sell to agribusinesses, skewing the results. Specifically, Vodacom's partnership with the Tanzanian government to access a fertiliser subsidy programme through M-Kulima led to a strong increase in farmer profiles (81% of the customer base).

The low conversion rate can also be attributed to agribusinesses' client processes and willingness to roll out digital procurement at their collection centres and train their staff to record transactions digitally. Dialog achieved the highest conversion rate of all grantees, with close to 40% of digitally profiled farmers having their sales digitally recorded. The value proposition of digital procurement resonated strongly with tea factories in Sri Lanka, which considered it both a strong competitive advantage and a tool for reducing pilferage and farmer attrition. This led tea factories to push digital procurement widely to farmers. Koltiva had the second-highest conversion rate (24%) and the highest number of farmers with digitally recorded sales. This can be attributed to the buy-in of their agribusiness clients, which operate in value chains where digitally enabled traceability and certifications are highly valued, such as cocoa and coffee. In Rwanda and Tanzania, uptake of digital procurement has been slow due to the technical challenges of rolling out digital procurement in the buying centres. That is why, despite having a high number of profiled farmers, Vodacom's digital sales records are low with a conversion rate of just 8%.

Figure 22
Number of farmers profiled versus farmers who had a procurement transaction recorded digitally

BI Data

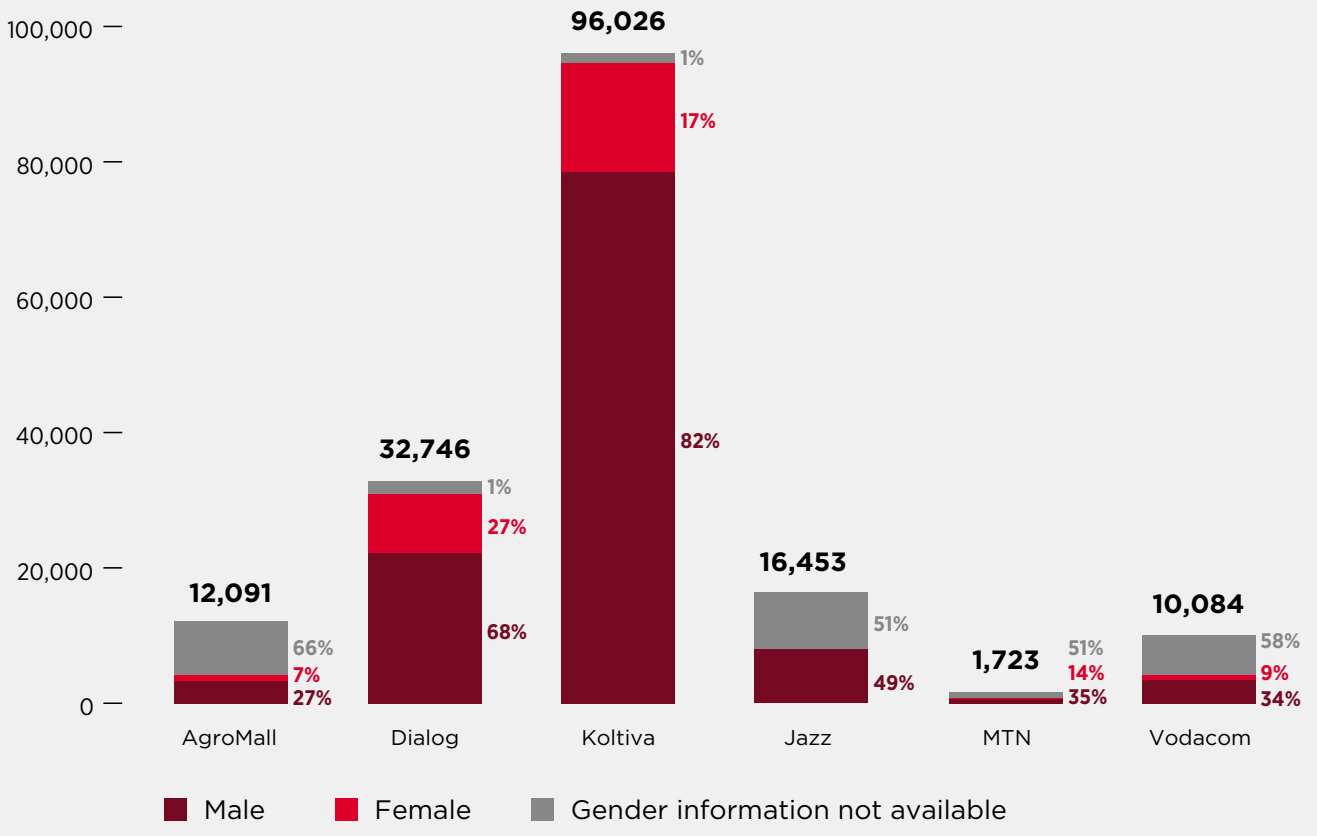


Most profiled farmers who had their sales digitally recorded are male (69%) while only 16% are female. Gender-disaggregated data also shows that profiled male farmers are 2.09 times more likely to have their sales recorded digitally than profiled female farmers, with conversion rates higher for male farmers (13%) than for female farmers (6%). These gender gaps stem primarily from social norms that limit women farmers from being the lead farmer responsible for selling crops in formal agricultural value chains. Although many agribusinesses did not have gender-disaggregated procurement data prior to the GSMA Innovation Fund, it is likely that gender-disaggregated digital procurement data reflects the existing farmer base selling to agribusinesses.

The proportion of women farmers who had their sales recorded digitally is particularly low in Pakistan (0.04%), where social norms around domestic and farming roles are particularly strong.[29] Only three women out of the known total female farmer base experienced digital procurement, estimated at 6% of all profiled users in Pakistan.

Figure 23
Farmers who had their sales recorded digitally, by gender

BI Data



"My husband has the responsibility of selling crops, buying inputs and controlling the money. [...] I carry all the risks during the farming season but still do not benefit from the effort I have made. It's only my husband who enjoys it."

Tanzanian farmer, female, 49 years old

"If the land is large and tea farming is the main source of income, often, a male member manages the farm and money. But if the farmland is small and income is less, male members engage in other work and women manage the farm. If women manage the farm, often they deal with the factory."

Sri Lankan tea farmer, female, 63 years old

29. CIMMYT. (2018). Gender Norms and Agency in the Pakistan Agriculture Sector. Policy Brief.

Service design considerations

UX research uncovered some of the pain points farmers experienced with digital procurement. The UX iterations that were made to the services are summarised in Figure 24.

UX research

Figure 24
Technology, service design and business model considerations for digital procurement

Challenges uncovered by UX research

1	2	3	4	5	6	7	8	9
Slow troubleshooting with initially outsourced software	Connectivity challenges faced by purchasing clerks when registering farmer sales	AMCOS do not always have smartphones or internet access to record procurement transactions digitally on the M-Kulima app	Farmers wanted a confirmation of the amount of tea leaves that had been accepted by the buyer	Requirements from agribusiness clients for detailed produce grading	Registration process was either too long (too much information collected upfront) or cumbersome	The logistics of agent visits were difficult for farms that were too far apart	Low activity, farmer loyalty or harvest supply	Registrations were slow with poor farmer engagement with the agent-based model

Technology	Content and features	Processess	Business model
1 2 3	4 5	6 7	8 9

UX iterations

1	2	3	4	5	6	7	8	9
AgroMall developed their own software from scratch with in-house developers to improve agility and reduce delays in resolving issues.	Ricult developed agent dashboards to help them monitor sales trends and offline functionalities.	M-Kulima was made accessible through USSD (while the existing app was discontinued) so farmers could access it with a basic feature phone.	Dialog now sends SMS receipts to farmers as a new feature.	AgroMall introduced produce quality grading (based on moisture, colour, etc.), which is factored in the payment calculations to farmers for both the B2B and B2C models.	AgroMall cut down the registration process to essential registration questions.	AgroMall prioritised co-located farms with software to plan agent visits more efficiently.	AgroMall added direct procurement with farmers (B2C) linked with their input loan service. Farmers sell rice directly to AgroMall to repay their input loan.	Vodacom shifted from B2B to a hybrid B2B/B2C model, using USSD to allow farmers to self-register.
	Koltiva introduced an offline mode for their procurement app. Synchronisation of procurement data was also improved, with near-instant sharing of purchasing clerk procurement entries with agribusiness dashboards.		Ricult introduced digital receipts for farmer procurement transactions that improved farmer trust and satisfaction.	Koltiva tailored user interfaces to include produce grading and improved the monitoring of farmer quotas for certified produce sales.	Reap Agro improved the registration experience by making geotagging of farms easier. The registration also shifted from self-registration to assisted registration through agents or host/young farmers to increase registrations. Ricult introduced a one-time password (OTP) autofill to make the registration process simpler for farmers.		Reap Agro shifted to a contract farming model protecting farmers from price volatility at the end of the season. Ricult shifted from procuring directly from farmers using their procurement software to providing their software as a service to agribusiness clients.	

User feedback on digital procurement solutions

Agritech agents and purchasing clerks

Agritech agents or purchasing clerks who work for agribusinesses or cooperatives primarily use digital procurement solutions when they collect and purchase produce from farmers (see Figure 19). This is why the digital procurement user journey begins with how these agents perceive and use the solutions.

Most of the agritech agents and purchasing clerks using grantees' digital procurement solutions have embraced the new systems, despite initial challenges understanding the value of them and how they work. The introduction of digital procurement is often received with scepticism by collectors, especially cooperative purchasing clerks with low digital literacy. Some purchasing clerks were concerned about losing some of the benefits associated with traditional procurement systems. For example, staff of the cooperative NOMA in Nigeria were afraid of losing commissions they usually receive from farmers after procurement was outsourced to AgroMall. In Sri Lanka, the tea factory Evergreen mentioned that some staff members resigned after the introduction of digital procurement, as the system would no longer allow them to compute additional margins from the books. Evergreen recruited a younger, more digitally savvy work pool to replace those who had left.

In a few cases, technical difficulties with hardware and low connectivity have seriously stalled service adoption, forcing agents to return to old systems (scales and paper records). In Rwanda, for example, issues with printers and the connectivity of digital scales initially prevented the agribusiness Rwanda Mountain Tea from using MTN's digital procurement solution. The low battery capacity of the devices also discouraged agents because batteries did not last a full day. This led to distrust among agents who thought they could not rely on the digital solution.

When these bottlenecks were addressed, cooperatives and agribusinesses reported that their staff found digital procurement systems easy to use and overall more efficient than traditional procurement processes.

Smallholder farmers

Across GSMA Innovation Fund grantees, farmers reported high acceptance levels with digital procurement services, finding the process quicker than manual sales records.

Of the surveyed farmers who had a procurement transaction recorded digitally by an agent, 77% on average stated that they preferred the new digital system to the old manual one.

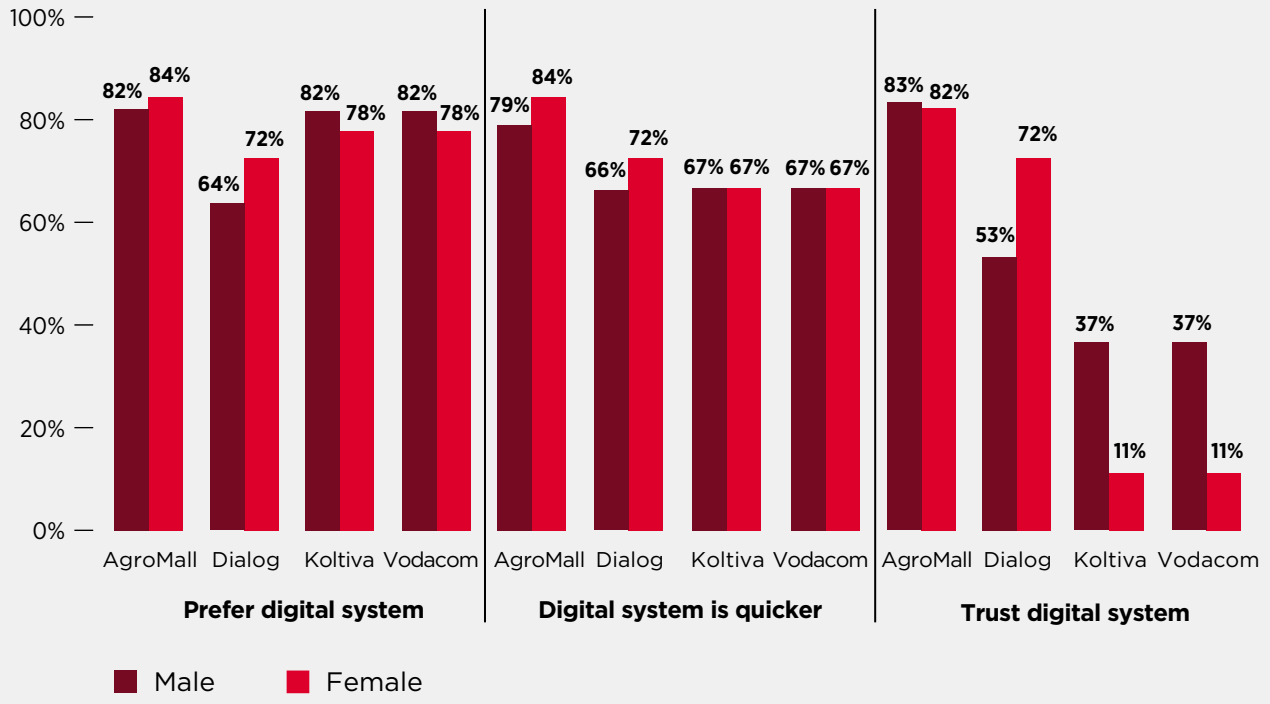
Figure 25

Monitoring surveys

Feedback from male and female farmers on digital procurement

(N=561)

The percentages represent male and female farmers who strongly agree with the statements



Farmers also mentioned that they enjoy the accuracy of digital scales, which can record more grams of produce than manual scales and reduce potential for conflict when purchasing clerks round down to the nearest 0.5 kg.

> "Those electronic weighing machines came with a warm welcome because we really needed them. The other existing methods were not trustful because they were not accurate."
>
> **Rwandan farmer, male, 44 years old**

Farmer satisfaction is higher when the value proposition is clear. For example, 93% of Indonesian farmers certified with Koltiva strongly agree that certification helps them increase farm revenue. Koltiva used digital profiling as the entry point for farmer certifications and subsequent premium payments for selling certified produce. This triggered overwhelmingly positive feedback from farmers, with 88% of surveyed farmers in Indonesia strongly agreeing that being profiled encourages them to implement all the required practices to become a certified farmer.

However, when the value of digital procurement is unclear, farmers tend to question digital records. For example, in Sri Lanka, Evergreen reported that farmers initially worried they would be taken advantage of, as they were unfamiliar with the process. Trials helped farmers realise the system was useful, and receiving SMS notifications made digital procurement tangible and verifiable for farmers. Vodacom reported trust issues when agents asked farmers for information to set up their digital profiles. However, Vodacom has been able to build trust by partnering with the Ministry of Agriculture on input distribution. By linking digital profiling with access to inputs, farmers see concrete upfront value and Vodacom has been able to digitally profile a large number of farmers.

Trust that agents would not make mistakes with digital procurement scales and software was lower in Tanzania and Indonesia for both men and women. Women demonstrated particularly less trust in agents (see Figure 25), which could be attributed to poor relationships between male agents and female farmers.

> "Sometimes [AMCOS] agents try to seduce me to have a relationship with them in return of favours such as being considered for a good payment [agents recording more kg of cotton than what the farmer delivered] or farming inputs or other products/services they give."
>
> **Tanzanian farmer, female, 31 years old**

Digital procurement outcomes for agribusinesses and cooperatives

Some grantees initially encountered resistance from agribusiness clients and purchasing clerks.

> "Tea factories were initially suspicious of why we were getting involved. We had to do a lot of explaining, with supporting data and evidence on how the system works, to get tea factories on-board. The COVID-19 pandemic also made it hard to build relationships."
>
> **Srinath Wijayakumara, Manager of Digital Inclusion, Dialog**

The digital recording of transactions provides higher value for agribusinesses when bundled with digital payments. In Tanzania, digital procurement records were generated by purchasing clerks through USSD and bundled with mobile money payments to farmers through M-Pesa. However, a few months after the introduction of digital procurement, a government levy on mobile money prompted the Tanzanian Cotton Board to advise against the use of digital payments. Digital procurement through USSD was then seen as slowing down the purchasing clerks who recorded sales. As a result, agribusiness clients reverted to manual procurement, prioritising sales efficiency over digital records.

Despite these challenges, agribusinesses in all grantee markets believe that digitising their procurement process creates a more transparent sales process, reducing fraud among purchasing clerks and mistrust among farmers. For agribusinesses and cooperatives, greater transparency translates into higher farmer retention and farmer loyalty.

In Sri Lanka where factories compete for supply, Evergreen reports that digital procurement has significantly reduced the discrepancies they used to see with intermediaries and manual scales. Transparency also increases farmers' trust, who can be confident that the numbers in the system are correct. Trust, in turn, helps the factory reduce farmer attrition and makes them more competitive than non-digitised factories.

Similarly in Rwanda, where agents used to underreport the amount they purchased from farmers, Rwanda Mountain Tea highlighted that receiving accurate data from collection centres strengthened trust among farmers.

> "The positive impact of the electronic system was that when purchasing the tea production from the farmer, we no longer had arguments related to them having a suspicion that I was stealing. On the contrary, even some additional grams were displayed and recorded which never occurred when using the manual method."
>
> **Rwandan male purchasing clerk, 30 years old**

In some cases, transparent digital procurement allows agribusinesses and cooperatives to secure more buyers and higher prices. The agribusiness Sugata in Indonesia reported that the digitisation of procurement has improved traceability and allowed them to add more buyers since traceability is in high demand in the coffee value chain. They are also able to secure higher prices from these buyers, which trickles down to farmers and improves farmer satisfaction and loyalty. Digital procurement also translates into a larger farmer base in markets where farmer allocation to agribusinesses is not regulated (Sri Lanka, Rwanda and Nigeria). The cooperative NOMA in Nigeria, for example, shared that digitising procurement encourages farmers to become cooperative members.

Digital procurement creates more organised and efficient processes. The number of data entry errors was reduced significantly across markets, increasing the productivity of agribusiness and cooperative workers. In Sri Lanka, Evergreen noted that digital procurement reduced staff workload as the previous system required a lot of manual data entry that could take two to three days and lead to mistakes due to handwriting issues. Alliance Ginneries in Tanzania reported more efficient processes, as staff can now access all data from the system and no longer need to carry papers everywhere. It also makes it easier to share mandatory information with government and other partners. Rwanda Mountain Tea reported improved monitoring of farmer performance as they could compare farmers' sales volumes to the farm size recorded during digital profiling and help extension services better advise farmers on how to improve yields.

Greater operational efficiency helps agribusinesses reduce costs. Although making the switch to digital involves investment in hardware, the operational efficiencies outweigh the costs. In Sri Lanka, Evergreen invested more than USD 150,000 of their own funds to provide staff with smartphones to use Dialog's Agrithmics service. They now find that higher farmer retention allows them to reduce promotional expenses, as they no longer need marketing to convince their farmers to continue working with them. They are also able to reduce losses, as intermediaries can no longer manipulate procurement figures.

Many of the grantees and partner agribusinesses reported that digital procurement also makes it easier to communicate with farmers. For example, Alliance Ginneries in Tanzania can now interact with a larger pool of farmers at a lower cost.

Digital procurement outcomes for grantees

While some grantees scaled much more than others, including Koltiva and Dialog, most anticipate they will experience tangible economic outcomes from digitisation. They believe these types of projects need time to become sustainable and that patient capital is needed for these services to develop and scale. AgroMall, for example, had to invest significant resources in building an in-house software team, which affected their break-even point.

Dialog reported satisfactory direct revenue-generating activities, even after an initial fee reduction for factories. The factories recorded digital procurement transactions worth LKR 450 million (USD 1.2 million)[30] every month with a farmer base of 32,000. Dialog also increased their mobile network subscriber user base by 10,000 customers thanks to digital procurement. This is a clear example of an MNO successfully leveraging their know-how in information services to expand their offering and use digital agriculture services to attract more customers to their core service offering.

30. Foreign exchange rate on 28 November 2022: USD/LKR=369

Digital payments

When selling their harvest to agribusinesses, farmers can choose to be paid in cash or by bank transfer or digital payment.

Digital payment models

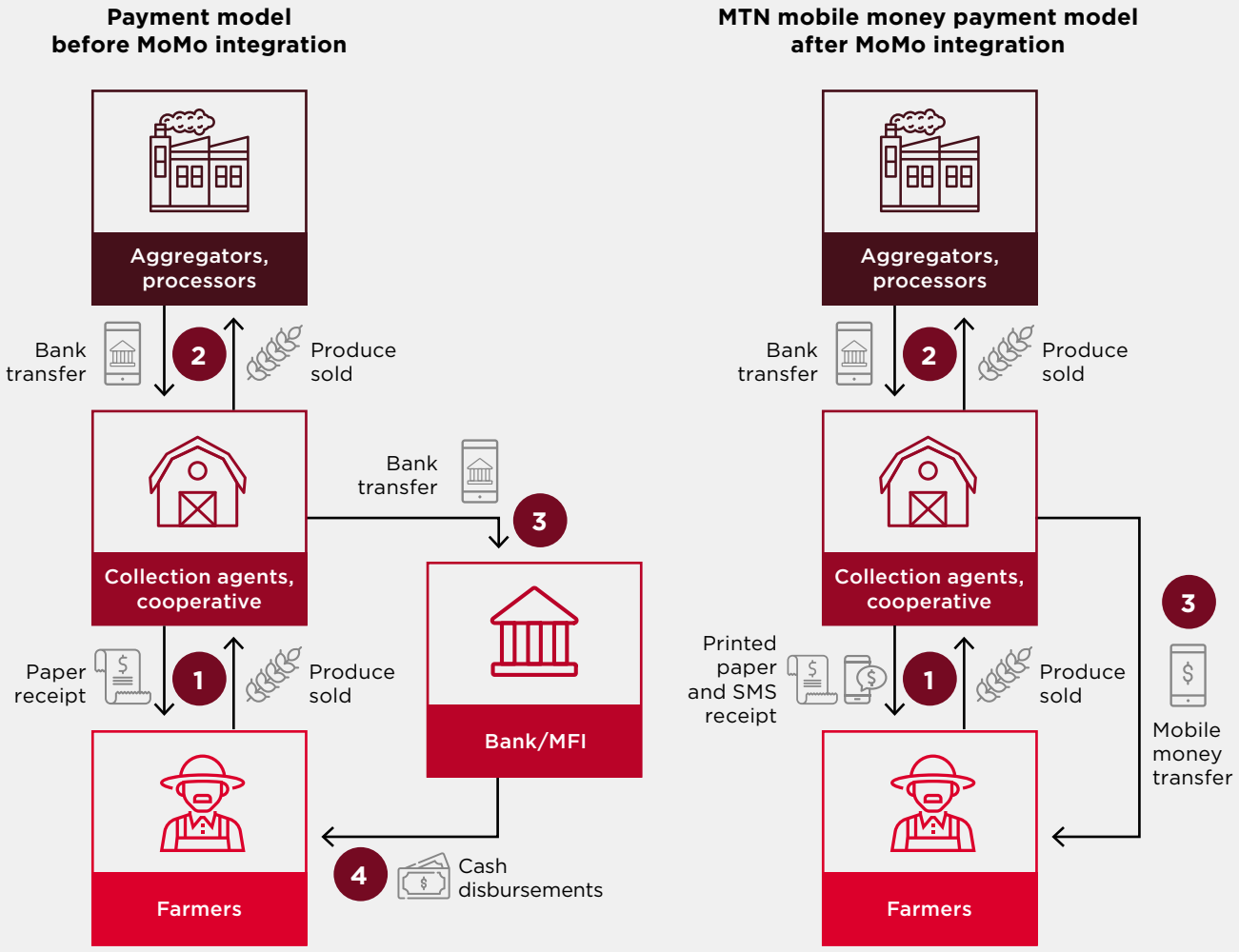
Five grantees launched digital payments to farmers using two different models: an MNO-led mobile money model and an agritech-led digital payment model.

Table 3
Digital payment models of GSMA Innovation Fund grantees

Mobile money model	Digital payment model
An MNO provides an enterprise solution to agribusinesses or cooperatives to pay farmers in bulk into their personal mobile money wallets. Farmers can use the mobile money wallets to cash out their wages, save their money or make payments, P2P transfers and airtime top-ups.	In markets where rural banking penetration is high and MNO-led mobile money is underdeveloped or prohibited, agritechs have developed app-based wallets. These wallets are typically linked to farmers' bank accounts and act as a record of payments received and a digital means of payment, primarily for inputs.
Jazz, MTN, vodacom	AGRO AgroMall, KOLTIVA

Farmers deliver their produce to cooperatives or buying centres where it is then sold to aggregators or processors further up the value chain. Before digital payments, aggregators would send bank or cash transfers to cooperatives upon receipt of the produce, which would then pay smallholder farmers in cash after a few days. Even partially formalised payments through rural banks were very inefficient. In Rwanda, for example, farmers used to be paid through a rural MFI. Rwanda Mountain Tea would transfer money to tea savings and credit cooperative societies (SACCOS) that would wire the MFI with a bulk payment to farmers. Farmers would then need to travel to the bank to receive their payment in cash on a rolling basis, which could take up to one week. During that week, the farmer would travel back and forth to the financial institution to check that their money was available and cash out their pay. This time spent away from farming reduced productivity and impacted the incomes of both farmers and agribusinesses.

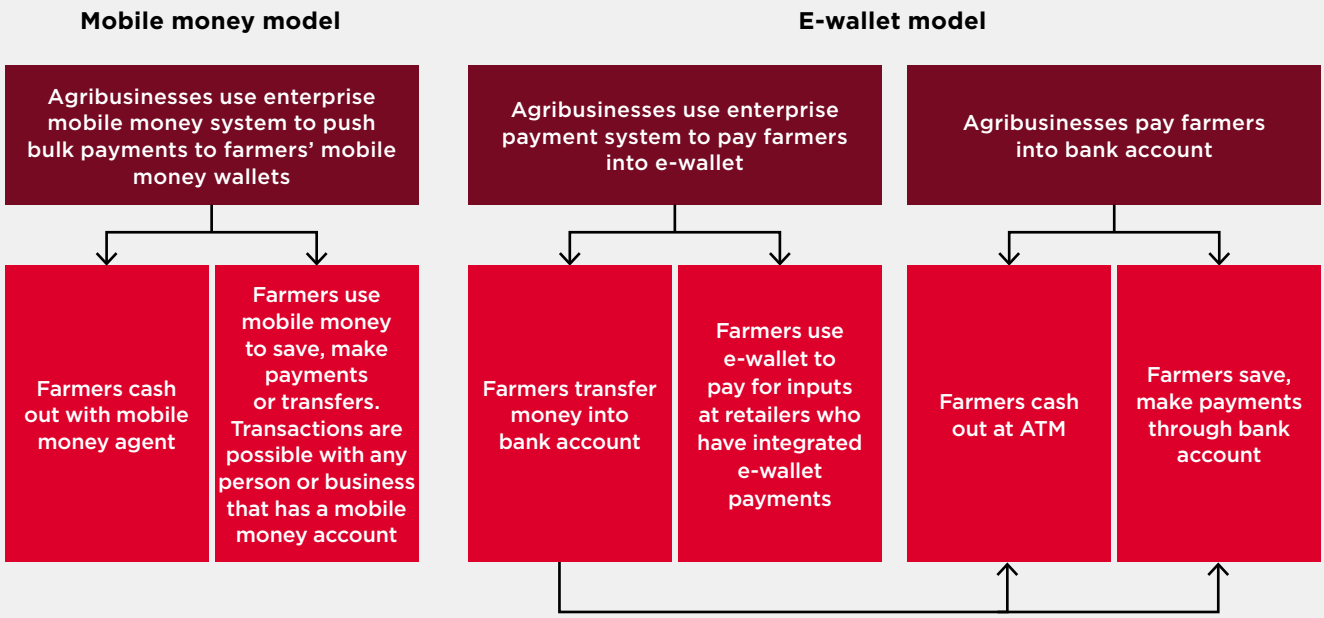
Figure 26
Integration of mobile money in digital procurement in Rwanda



In Tanzania, agricultural marketing cooperative societies (AMCOS) used to receive cash from Alliance Ginneries officers, and when farmers came to sell their cotton AMCOS agents would pay them and write a receipt. All transactions were recorded on paper (money paid, amount, any input credit deductions), creating a lot of paperwork.

MNO-led mobile money payments and digital payments through agritech e-wallets involve different user journeys.

Figure 27
User journey for a mobile money model versus an e-wallet model



Digital payment adoption

Digital payments have been slow to take off. They represent only a small proportion of total payments made to farmers and a significant number of farmers are still paid in cash. Overall, 32% of farmers with digitally recorded sales have received some form of digital payment for their produce, either through mobile money or an e-wallet. All 28,389 Rwandan farmers who have had a sale recorded digitally were paid through MTN's MoMo wallet. In part, this is because mobile money was already widely used in the farming communities where the project took place, and the National Bank of Rwanda (NBR) has also mandated zero charges for cashless payments and raised the limit for mobile money transfers during the COVID-19 pandemic.[31]

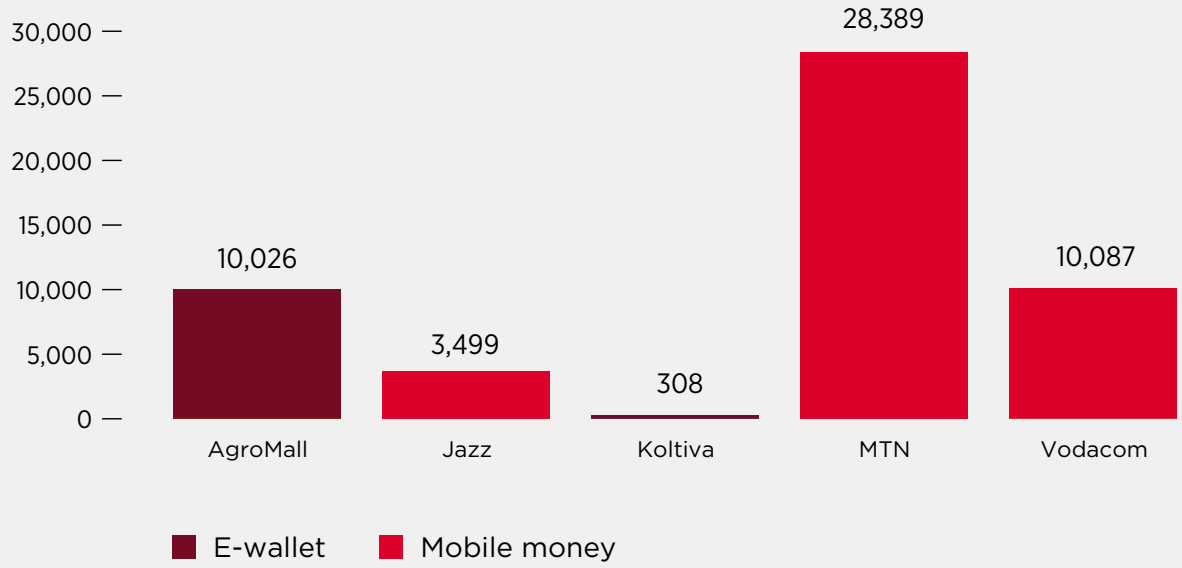
However, there has only been marginal uptake of digital payments in other markets (see Figure 28). Mobile money ecosystems in some of these markets are less mature. Koltiva made 41,415 cash payments to farmers against 308 digital payments. Indonesia has a high rate of rural banking penetration, with 45% of the rural population owning a bank account.[32] This limits the value of mobile-led digital payment solutions as an alternative to banking services. Koltiva farmers also indicated that they preferred to be paid in cash. This was largely due to high transaction fees for digital payments, the lack of an ecosystem for farmers to spend their digital money and a lack of cash-out points in the early days of the service that required farmers to transfer money to a bank account to cash out. Similar challenges with digital payments were evident in Nigeria, and while cash incentives helped to attract users, the reliance of e-wallets on bank accounts to cash out limited the value proposition.

While mobile money ecosystems in Tanzania and Pakistan are relatively well developed, low adoption of digital payments is primarily linked to the high transaction fees for mobile money, which led farmers to resort to cash or in the case of Pakistan, to bank transfers (6,131 bank transfers payments made to farmers).

31. NBR. (21 March 2020). PUBLIC NOTICE: The National Bank of Rwanda would like to inform the public. Whereas changes to transaction limits were made permanent, the removal of charges for digital payments had a 90-day expiration period.
32. World Bank. (2022). Global Findex Database 2021.

Figure 28
Number of digital payments made to farmers

BI Data



Gender-disaggregated data was largely unavailable for the 81% of farmers who received digital payments from GSMA Innovation Fund grantees. This was due to a lack of alignment between farmer information in digital payment systems and farmer profiles. Based on available data, 16% of farmers who received a digital payment were men and 3% women.

Figure 29
Technology, service design and business model considerations for digital payment

UX research

Challenges uncovered by UX research

1	2	3	4	5	6	7
Difficult reconciliation between procurement and payments	Strong preference for cash	Pain points in user experience	Low awareness	Farmers give wrong reference numbers to agents, leading to payment errors	High transaction fees	Bottlenecks linked to farmers owning a SIM from other providers

Technology	Content and features		Processes		Business model	
1	2	3	4	5	6	7

UX iterations

1	2	3	4	5	6	7
JazzCash payments were integrated with Ricult and Reap Agro procurement solutions.	Introduced multiple payment layers for procurement payments and premiums: 1. KoltiPay wallets 2. Bank transfer feature 3. Koltipoints (for digital payments of premiums), that are redeemable for agri-inputs.	Changed the interface design to make the main features more visible.	Created marketing content to raise awareness of KoltiPay and leveraged Koltiva agents to raise awareness among farmers.	Vodacom introduced a double verification system.	AgroMall waived fees associated with e-wallet money transfers to bank accounts to reduce barrier to adoption for farmers.	Reap Agro adopted a provider-agnostic approach to mobile money payments and integrated wallets from other providers.

2	3	6
A split payments functionality was added for KoltiPay, bank and cash to ease user adoption.	Simplified the user flow, such as the login process.	Koltiva explored a new vendor to reduce transaction fees and is introducing incentives for farmers and agents to adopt digital payments.

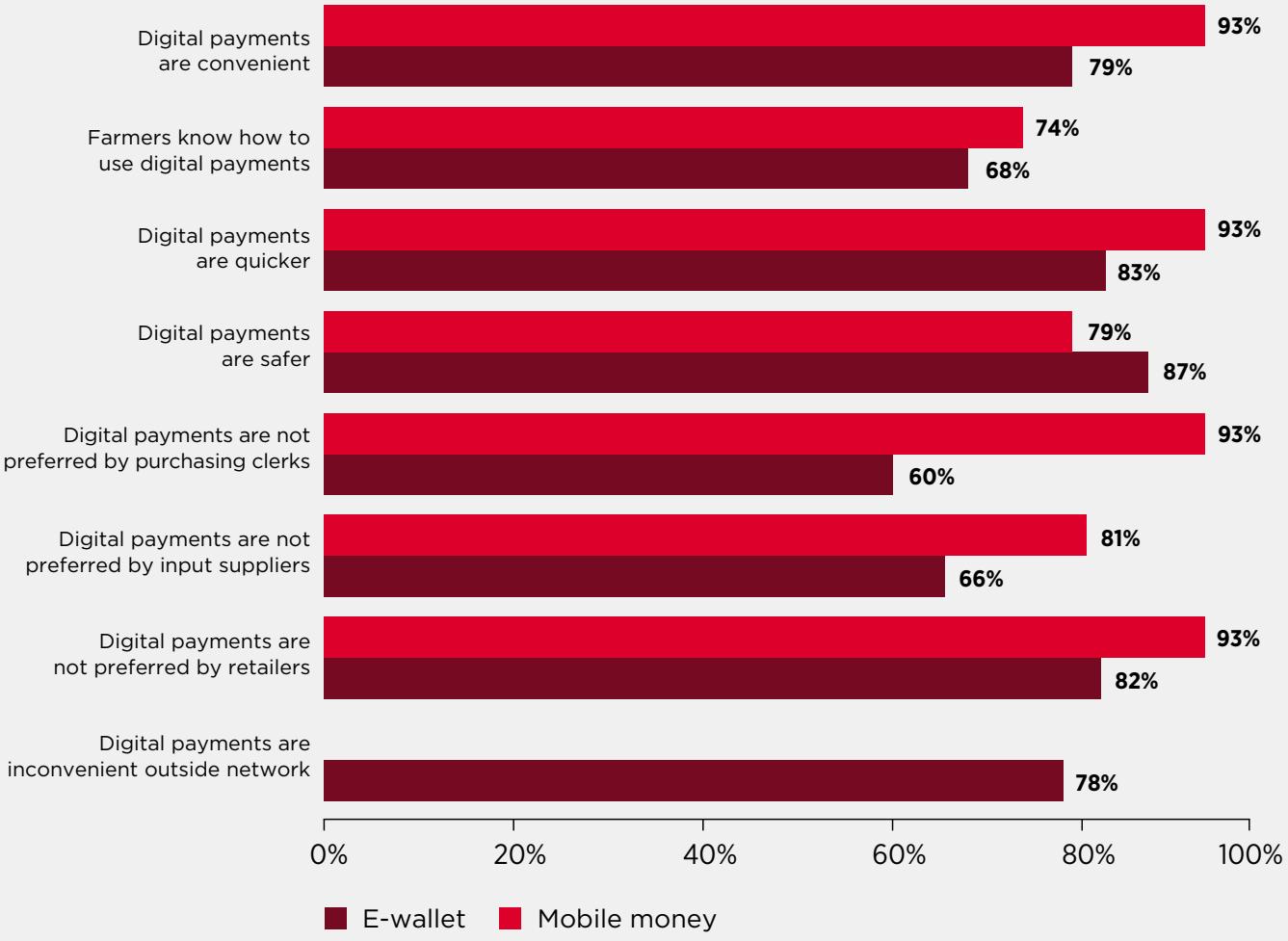
2
Introduced split payments of mobile money and cash to make behaviour change easier.

User adoption and feedback on digital payment solutions

There were small differences in digital payment acceptance depending on the model used and market maturity for digital payments. Overall, early adopters shared positive feedback on the convenience, ease of use, speed and safety of digital payments. Mobile money wallets were introduced in markets with an existing mobile money ecosystem and received slightly more positive feedback compared to e-wallets, which were introduced in countries where mobile money payments are nascent. However, these early users also widely reported usage barriers with underdeveloped digital ecosystems.

Figure 30
Feedback from early adopters of digital payments
(N=258)
The percentages represent farmers who strongly agree with the statements

Monitoring surveys



E-wallets developed by agritech grantees had less positive feedback compared to mobile money wallets. In Indonesia, payments were predominantly made in cash, which made it difficult to test user acceptance of digital payments with such a low sample size. Farmers who used AgroMall's wallet complained of the lack of interoperability and lack of option or low acceptance of digital payments at retailers and input providers, both of which made the e-wallet impractical.

Overall, safety was the main value proposition of digital payments for farmers, with 87% of surveyed farmers across the five markets strongly agreeing that digital payments are safer than cash.

> "Going around with money on my mobile phone is a very secure way because thieves cannot easily identify that you have money when you don't carry cash and the money is readily accessible and quick to use everywhere and at all times."
>
> **Rwandan farmer, female, 67 years old**

Speed and convenience were other tangible benefits, with 88% of farmers strongly agreeing that digital payments are faster than cash payments. Compared to two-step payment models, whereby cooperatives send payments to a bank for farmers to collect, digital payments do not require farmers to physically travel to bank branches.

> "Getting paid at the bank is not easy, both due to the time spent in the long queue which is difficult to me as an old man and having to pay the transport fee to go to the bank."
>
> **Rwandan farmer, male, 60 years old**

Finally, qualitative surveys revealed that farmers appreciate having access to a tool that helps them better manage their finances.

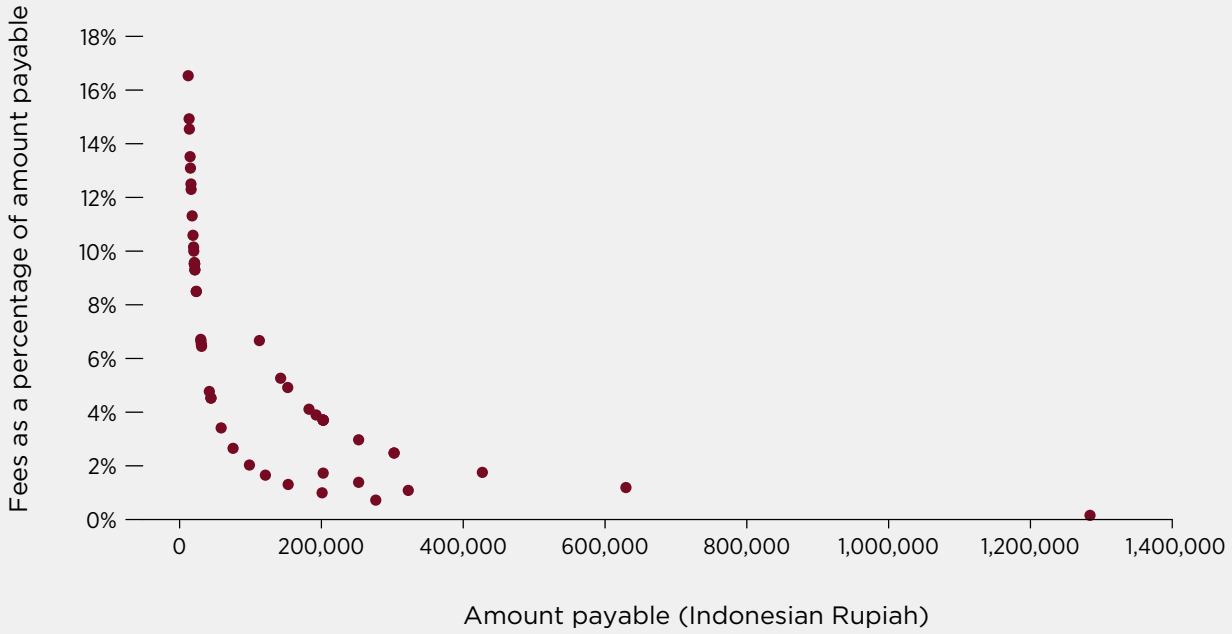
> "The advantage is better money management. My husband is the one who usually collects the payments and most of the time he will spend almost half of the money before coming home with the remaining. When we are paid to the M-Pesa wallet, he cannot spend it because he does not have the money in hand and cash out points are not close by."
>
> **Tanzanian farmer, female, 42 years old**

While farmers acknowledge that digital money is safer than cash, and in most cases faster to receive, these benefits do not outweigh the high fees, low awareness and lack of a value proposition in underdeveloped ecosystems. Across all five grantee markets where digital payments were rolled out, 73% of farmers reported that input dealers prefer to pay and be paid in cash, and 89% claim that retailers prefer to be paid in cash, which could be due to merchant fees on mobile money payments. This means that, beyond cashing out, the use of digital money is severely limited. Transaction fees have also been perceived as prohibitive by smallholder farmers.

> "The negative part is the charges when I want to withdraw my money especially when withdrawing a high amount."
>
> **Pakistani farmer, male, 50 years old**

Figure 31
Digital payment transaction fees in Indonesia as a percentage of the value of produce sold

BI Data



In Indonesia, for example, the fixed transaction fees of Koltiva's initial third-party vendor were disproportionate for lower transaction values – as high as 17% of the farmer's total payment, according to GSMA BI data. Koltiva has since pursued a partnership with another vendor to offer a digital payment service better suited to smallholder farmers.

Despite Tanzania being a relatively mature mobile money market, with 39% of the adult rural population having a mobile money account,[33] price sensitivity was still an issue. The introduction of a government levy on mobile money transactions in July 2021[33] led to higher fees and prompted the Cotton Board to advise cooperatives to cease mobile money payments to farmers. This caused M-Pesa payments to drop and marred farmers' perception of mobile money.

> "The negative part are the charges that apply whenever you want to cash out which are too high."
>
> **Tanzanian farmer, male, 60 years old**

33. World Bank. (2022). Global Findex Database 2021.
34. Mbugua, C. (4 July 2022). "The Reduction of Mobile Money Levy in Tanzania". *GSMA Sub-Saharan Africa News*.

Digital payment outcomes for agribusinesses and cooperatives

Digital payments provide a clear value proposition for enterprise solution users. Prior to digital procurement and payments, cash flows for produce buyers were difficult to manage, records were prone to errors and payments were slow. Digital payments allowed Rwanda Mountain Tea to reduce payment delays to farmers by up to a week as cooperatives could pay farmers directly through mobile money. Since procurement data is automated, agribusinesses can approve farmer payments faster because they know how much each farmer is owed in near-real time (depending on connectivity). Before the government levy in Tanzania was introduced, Alliance Ginneries noted that digital payments reduced cash flow issues at AMCOS as they could send money digitally. In Sri Lanka, digital payments sped up the payment process for purchasing clerks, who shifted from making 45 individual payments to one bulk payment a day. In addition to being efficient for agribusinesses, bulk payments can also be cost-effective. When Koltiva introduced bulk digital payments to farmers, they were able to consolidate their banking fees into one lower payment.[35]

For cooperatives and agribusinesses, the switch to digital payments made it safer to pay farmers as they no longer needed to handle large volumes of cash. Paying farmers has become less risky with direct transfers. Sugata in Indonesia used to face significant risks when transporting cash for procurement (involving IDR 2 to 3 million or USD 128 to 192)[36] to villages in conflict-affected areas. Digital payments also mitigated risks for Alliance Ginneries in Tanzania.

> "Before the project, we had to go around with a bulk of money; there had been several cases of robberies in the past, and we lost a lot of cash. With Vodacom's M-Pesa service, we increased the security, and now have a safe way to pay farmers."
>
> **William Malecela, Field manager, Alliance Ginneries**

Digital payment outcomes for grantees

Digital agriculture payments represent an important revenue opportunity for grantees in mobile money markets. The GSMA estimates that digitising agricultural B2P payments could generate USD 3.2 billion in revenue for mobile money providers (MMPs) in 2025.[37] However, this depends on MMPs operating in an enabling regulatory environment and having the necessary assets in place, such as sufficient numbers of agents and sufficient liquidity in rural areas. In addition to revenues from transaction fees, MMPs could also benefit from the addition of new mobile money customers in rural areas, greater customer loyalty or stickiness and increased agent activity. All this can support the development of the mobile money ecosystem and uptake of adjacent products, such as loans and insurance.[38]

35. Koltiva pays most of their farmers via bank transfer, with digital payments representing less than 0.5% of total payments.
36. Foreign exchange rate on 24 November 2022: USD/IDR=15,629.
37. GSMA. (2020). GSMA AgriTech Toolkit for the Digitisation of Agricultural Value Chains.
38. Ibid.

Digital advisory

Digital advisory models

Digital advisory provides agronomic and livestock advice to farmers, as well as information on best practices, market prices and/or financial and digital literacy training.[39] Digital advisory can also include advice on weather and climate, including weather forecasts.

The six Innovation Fund grantees explored different digital advisory models, from push SMS to call centres, apps and IVR. Table 4 provides an overview of each model.

Table 4
Digital advisory models of GSMA Innovation Fund grantees

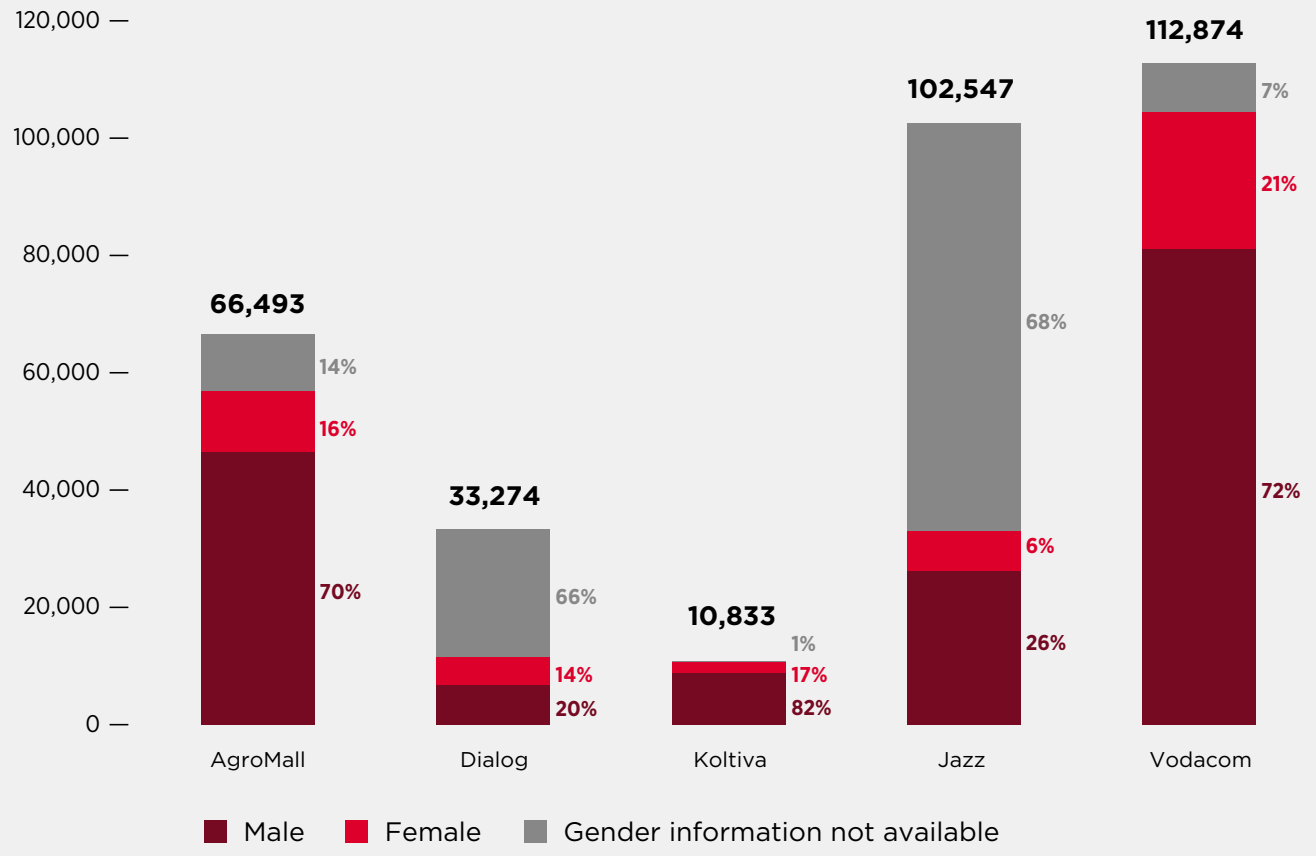
	Grantees	Registration	Service access	Service usage	Repeat usage/ follow-up
Push SMS	AGRO AgroMall Jazz vodacom	SMS is included as a bundle and shares a registration journey with agent-led farmer profiling and registration for procurement. Vodacom's SMS weather forecasts have a separate self-registration process through USSD.	SMS are sent to farmers by the advisory service at key points in the growing season or during specific events, such as crop disease outbreaks.	Farmers open and read SMS content and can keep or delete it.	Frequency of SMS is determined by the advisory provider. SMS can be supplemented with extension agent visits to follow up on SMS agronomic advice.
IVR	Dialog	Farmers self-register to the IVR service by responding to an interactive OBD message or dialling a number.	Farmers call a dedicated phone number to access the IVR menu.	Farmers use the IVR menu to access voice-recorded agronomic advice.	Push OBD messages are sent to farmers to sustain engagement.
Call centre	Jazz	Farmers are registered to agronomic advice by call centre agents.	Farmers call a dedicated number to access call centre agronomists.	Agronomists provide advice to farmers by phone.	Farmers call the call centre at their leisure. Agronomists can schedule in-person visits to assess crops.
App	Dialog KOLTIVA Jazz	Farmers self-register through a smartphone app. Agents may provide support to farmers to download the app.	Farmers open an advisory app on their smartphone to access the landing page.	Farmers navigate the app menu to access text, audio and video content.	Farmers use the app at their leisure and can receive new content notifications.

39. GSMA. (2020). Digital Agriculture Maps: 2020 State of the Sector in Low- and Middle-Income Countries.

Digital advisory services adoption

Figure 32
Farmers using digital advisory, by gender

BI Data



Using push SMS to deliver advisory content to farmers was found to be the most successful model for reaching farmers. Vodacom, Jazz and AgroMall, all of which provide push SMS, capture 86% of digital advisory users combined.

Mobile apps have a smaller user base among farmers since they require smartphones, and farmer engagement with apps remains a challenge. Of the farmers who registered to advisory apps, an average of 25% are inactive. This rate is especially high in Indonesia where 32% of farmers who downloaded the Koltiva app have never used it. This is due to lower awareness of app features, as well as connectivity issues, which was reported as a major pain point by app users. Activity rates for apps are relatively low: 39% of advisory app users are repeat users and 36% are one-time users.

All advisory solutions have fewer female users than male users, with ratios reflecting the gender disaggregation of the digitally profiled farmer base. However, outreach varies widely depending on the advisory channel. For advisory offered via SMS, almost all women farmers who were digitally profiled have accessed it. In comparison, apps reach a much smaller share of the female farmer base. Koltiva's advisory app was only downloaded by 3% of women farmers who were digitally profiled, while Jazz had no available gender data on their advisory users. Dialog's 6,781 registered female users on Govi Mithuru are all IVR/OBD users, while the number of women using the app version is unknown as it has different registration requirements.

Service design considerations

UX research

Figure 33
Technology, service design and business model considerations for digital advisory

Challenges uncovered by UX research

1	2	3	4	5	6
M-Kulima advisory was initially app-based, which limited adoption by most farmers.	Farmers found content too theoretical, not adapted to their needs and/or difficult to understand.	IVR users had to listen to advice for all states in alphabetical order.	Farmers were not aware of new advice or additions to the service.	Farmers thought they were receiving too many SMS messages.	Low adoption of advisory services.

UX iterations

1	2	2	2	3	4	5	6	6
M-Kulima advisory has been made available on USSD to allow wider access. Farmers are also now able to self-register.	Ricult added a Q&A forum to the app so farmers can ask questions and upload photos for expert advice. Farmers can also pin posts and vote on the forum to help address the most common issues they face.	Koltiva developed a climate-smart advisory feature that told farmers what to do on the farm in response to the weather forecast.	Reap Agro's advisory partner, BKK, simplified content to make the app easier for farmers to use. Video content was uploaded.	Dialog improved IVR menu navigation and access by shortening the process by which farmers select their location.	Push notifications from app and SMS advisory were introduced.	Reduced the frequency of SMS to only be sent during key points in the growing season.	Leveraged commission-based 'activators' to register farmers.	
	Ricult added in-house localised content development for farmers in regions where there is a high concentration of users.	Dialog requested its advisory partner, the Tea Research Institute, to simplify its content.			Included SMS notifications as a new feature to inform farmers about additions to the advisory service.		Leveraged purchasing clerks to promote the digital advisory service.	

Technology 1 | **Content and features** 2 3 4 | **Processess** 5 | **Business model** 6

User adoption and feedback on digital advisory

Farmers perceive SMS as user-friendly and reading rates are consistently high. SMS advice was widely appreciated, with 80% of surveyed AgroMall farmers and 77% of surveyed Vodacom farmers strongly agreeing that they liked the format. The reading rate for SMS was relatively high for a service that requires very little farmer engagement, with 84% of farmers on average reading almost, if not all, the advisory SMS they receive.

Figure 34
Digital advisory registration and usage funnel, by type of delivery channel[40]

Monitoring surveys

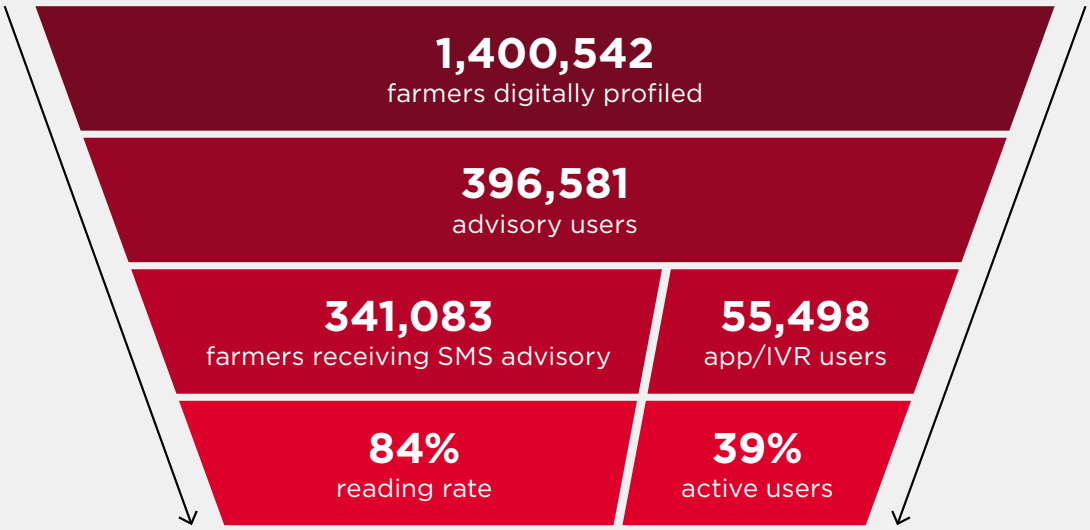
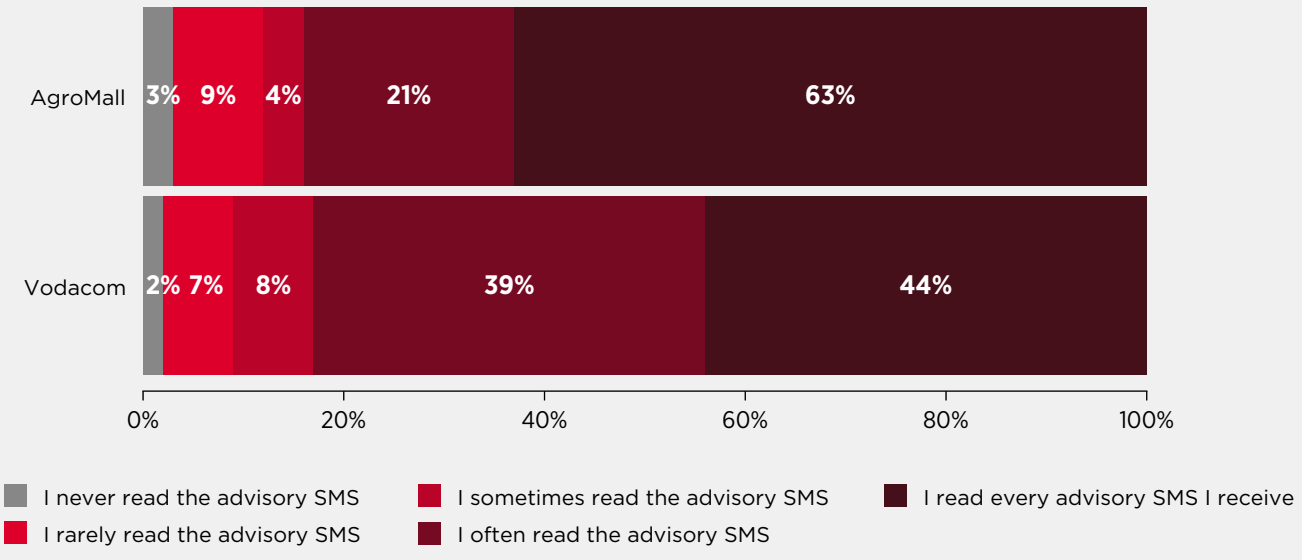


Figure 35
SMS advisory reading rate in Nigeria and Tanzania
(N= AgroMall: 275, Vodacom: 169)

Monitoring surveys



40. "Active SMS users" are defined as the percentage of farmers who report reading all the SMS they receive. "Active usage" for an app and IVR is defined as the percentage of farmers who have used the service more than once.

Digital advisory is more likely to be understood when it uses simple terminology (i.e., non-scientific). The rate of understanding the entirety of SMS content varies significantly between services. For example, in Tanzania, monitoring surveys revealed a significant drop in understanding of SMS content following agronomic advice that used scientific terms for plants, particularly among farmers with lower levels of education.

Access to content and understanding have proven more difficult with app-based models (pull content) compared to SMS (push content). Advisory apps contain more information than SMS and farmers are less likely to understand all the features, content and benefits of the app. This has a negative impact on farmer satisfaction with app formats, which is lower on average than for SMS-based advisory. For example, 42% of Dialog's Govi Mithuru app users are satisfied with the app format compared to 43% of IVR users and 46% of outbound dialling (OBD) message users. Meanwhile, 65% of Koltiva FarmCloud users are satisfied with app content compared to 80% for AgroMall SMS users and 77% for Vodacom SMS users. Farmers who have access to both app and SMS weather forecasts, as in Pakistan for example, report that they use the SMS weather forecasts more. App users are less likely to notice the weather forecast in the app menu. In Indonesia, only 4.6% of farmers who use the app navigate to the daily and weekly weather forecast page. Farmer surveys found that lack of awareness of the weather feature on the app and ability to navigate the feature are key barriers to using the service.

High frequency of push advisory messages leads to lower satisfaction. A significant share of farmers who have received an advisory SMS report that they receive too many messages: 45% for AgroMall, 26% for Reap Agro and 66% for Ricult. A similar trend is observed for push IVR messages. In Sri Lanka, 35% of surveyed users of Dialog's IVR strongly agree that they receive too many push IVR messages. Advisory service providers need to regularly review customer satisfaction survey results and adjust the frequency of their message delivery accordingly or based on the crop calendar.

Providing timely and accurate climate-smart advisory, especially weather forecasts, has proven challenging in some markets. While most farmers claim that digital weather forecasts improve their access to weather information, feedback varied on the accuracy of the forecasts. All services rely on national meteorological agency data, the quality of which might vary depending on where farmers are located. Anecdotes of low-accuracy forecasts were shared by farmers in Northern Pakistan:

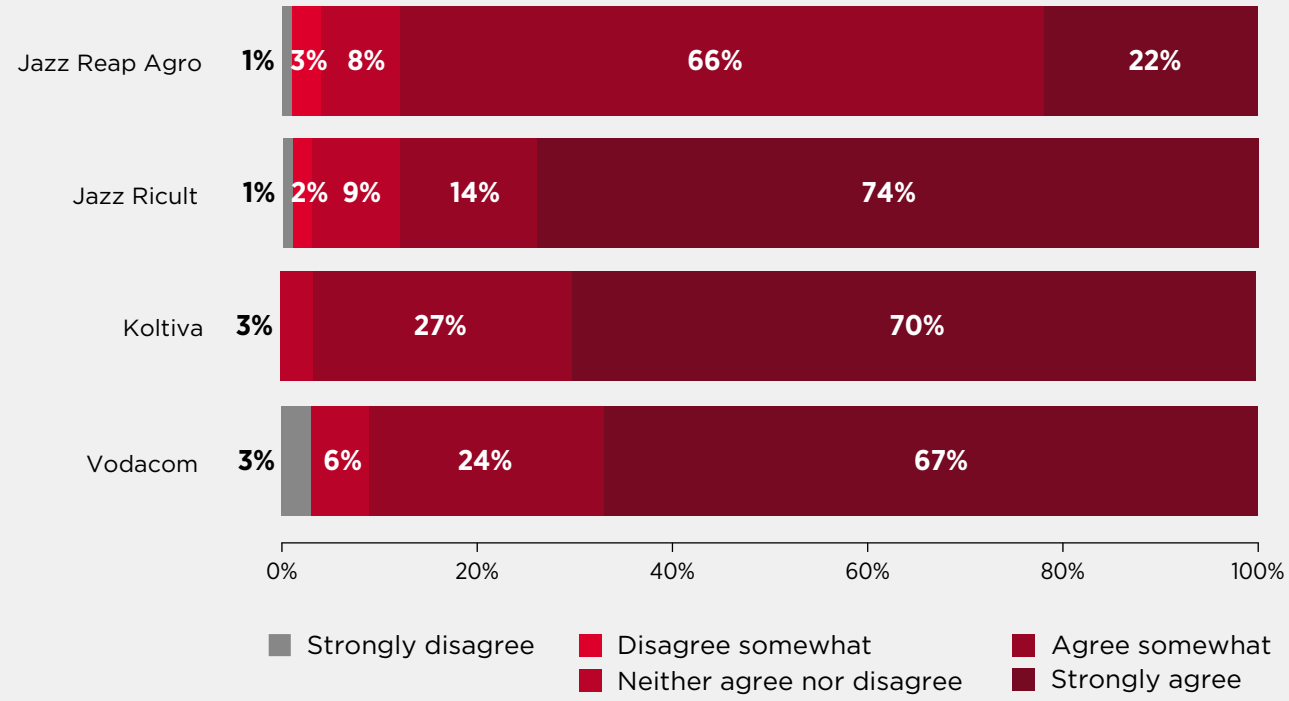
> "I read weather messages, but I don't really believe them. Today was my watering turn and I have received the message about heavy rain on Friday which is today, it's afternoon but still there is no sign of rain."
>
> **Pakistani farmer, male, 54 years old**

Meanwhile, surveys in Tanzania and Indonesia show that farmers perceive weather forecasts as highly accurate: 75% and 92%, respectively. However, in Indonesia, Mirza, Director Operational at the agribusiness Sugata, also shared that:

> "The weather advisory feature on FarmCloud is problematic. It could be raining in the morning in the village, and the app would advise to apply fertiliser. As the weather changes rapidly here, the recommendation could change to pruning if it is sunny in the afternoon, making it impossible to implement any kind of advice".
>
> **Mirza, Director Operational at the agribusiness Sugata**

Monitoring surveys

Figure 36
Farmer perceptions of whether the digital service improved their access to weather forecasts
(N=518)



Digital advisory is especially well received during key farming activities. In Tanzania and Nigeria, UX research found that the weeding and planting period was one of the most important times for advice, with farmers finding advisory on herbicide use and planting techniques particularly useful.

> "The advisory through AgroMall impacted me because I received important messages on when to apply the fertiliser after planting the rice seeds."
>
> **Nigerian farmer, male, 56 years old**

> "I have received a lot of information from Govi Mithuru about tea growing. I get this information very often and on the whole cycle of tea growing. They advise me on how to prepare the land, how to plant the trees, how to prepare the beds, etc. I followed the advice on distance between plants, fertiliser alternatives, soil erosion and on weed recycling."
>
> **Sri Lankan farmer, female, 63 years old**

Smallholder farmers are unlikely to change their behaviour based on digital advisory alone. More than half (55%) of smallholders across the GSMA Innovation Fund portfolio said that they implemented some advice from the digital advisory, but 48% of users in Nigeria and Pakistan said they preferred to stick to their habits when they receive advice they are not used to or is new to them.

To change behaviours, interactive approaches are still preferred. Several grantees use digital advisory to complement agent advisory and manage the flow of queries to agents. During interviews with farmers, most expressed that rather than simply receiving an SMS or using an app, they prefer to meet with a representative in person because they know them and their land. Using interactive digital approaches, such as forums and call centres with experts, also spurs farmer engagement as they value interactive conversations.

> "When we share the image of a crop disease, the whole farming community will see it and every piece of advice we get from BKK will help all farmers at the same time. We also share our voice messages, videos and photos via the app."
>
> **Pakistani farmer, male, 32 years old**

> "So far, I prefer to call the BKK representative, because we have been working with them for a long time and they know our soil, weather and every crop. They then give us instant advice and visit us frequently, the same day in case of an emergency."
>
> **Pakistani farmer, male, 24 years old**

Digital advisory outcomes for agribusinesses and cooperatives

Digital advisory allows crop buyers to send notifications and disseminate information to farmers in a timely and cost-effective way. While agents are still important to driving behaviour change among farmers, relying solely on agents is costly for agribusinesses and cooperatives as farmers are in remote areas and spread out geographically. Digital advisory can be a cost-effective supplement to agent advice. The efficiencies introduced by digital advisory can allow agribusinesses to better manage production quality and secure higher crop prices.

Digital advisory outcomes for grantees

The benefits of digital advisory vary depending on a grantee's revenue model. While some grantees charge farmers for advisory content, others provide it as part of a bundle. The premium model offered by Dialog, for example, costs farmers LKR 30 per month (USD 0,08). Despite the low price, Dialog reported revenue generation of up to LKR 500,000 (USD 1,342) per month.[41] For providers who have chosen to offer digital advisory for free as part of a bundle, such as AgroMall, advisory is considered to add value to other services, lower the costs of in-person agronomic advice and generate indirect benefits in the form of higher farmer satisfaction and improved crop yields.

41. Foreign exchange rate on 28 November 2022: USD/LKR=369.

Loans

Loan models

One hypothesis of the GSMA Innovation Fund was that the digital economic identities created through digital profiling and procurement records would allow farmers to access loan services, as data generated from digital procurement would be shared with FSPs to support credit scoring. However, this model has proven challenging to implement across the grantee markets. While some grantees partnered with FSPs to underwrite input loans, no grantee was able to establish a data-sharing partnership with a regulated financial institution to provide cash loans to farmers.

The main barrier is buy-in from financial institutions, which did not consider procurement and digital profile data sufficient to support their Know Your Customer (KYC) and scoring system requirements. Most still required farmers to provide collateral, as well as large amounts of documentation, which farmers often do not have. For example, Koltiva tried to facilitate access to loans for farmers, but *"documentation and collateral was excessive with local banks. A small number of farmers were successful."* For digital economic identities from procurement to unlock access to loans, more efforts are needed to communicate the business opportunity to FSPs.

During the GSMA Innovation Fund, alternatives to cash loans from FSPs emerged to address farmers' basic financing needs. These models are described in Table 5.

Table 5
Loan models of GSMA Innovation Fund grantees

Agritech-led input loans (in-kind or cash repayment)	Input loans through a partnership with a cooperative	MNO-led mobile money overdraft service
AgroMall issues in-kind input loans to their farmer clients. This model requires AgroMall to deploy their agents to help farmers request input loans and secure inputs from input providers. The monetary value of the input is repaid by farmers in-kind against the monetary value of the agricultural produce they sell to AgroMall. Cash repayments are possible. Jazz's agritech partner BKK/ Reap Agro follows a similar model with in-kind produce repayments at a pre-determined price. The in-kind input loans are carried on their bank partner's balance sheet.	Koltiva partnered with a cooperative to offer in-kind input loans to farmers, with repayments made in-kind.	Vodacom integrated their Songesha overdraft service in the M-Kulima USSD menu for M-Pesa users. Farmers can request overdraft amounts that vary according to their overdraft history and repay the overdraft with their mobile money balance within a maximum of 30 days. The overdraft amounts are underwritten by their MFI partner.

In 2023, Vodacom will be developing a data-as-collateral model with an MFI partner in Tanzania. Since Songesha limits are often insufficient to meet farmers' needs, Vodacom have been working on a new digital agriculture loan to complement the existing overdraft facility. Under this model, procurement data will be fed into credit scoring to deliver cash loans to farmers. The product is currently being piloted with tea farmers.

AgroMall considered using economic identities created from track-and-trace procurement records to assess farmers' creditworthiness and offer larger input loans. However, when they encountered challenges partnering with FSPs, AgroMall acquired Garun Mallam Microfinance Bank Limited to facilitate future digital financial services for farmers.

Loan services adoption

Digital loans have a strong value proposition for smallholder farmers. UX research and monitoring surveys reveal strong demand for loans in farming communities. The agribusiness Sugata in Indonesia considers digital loans "the most attractive value proposition" for farmers in digitised value chains.

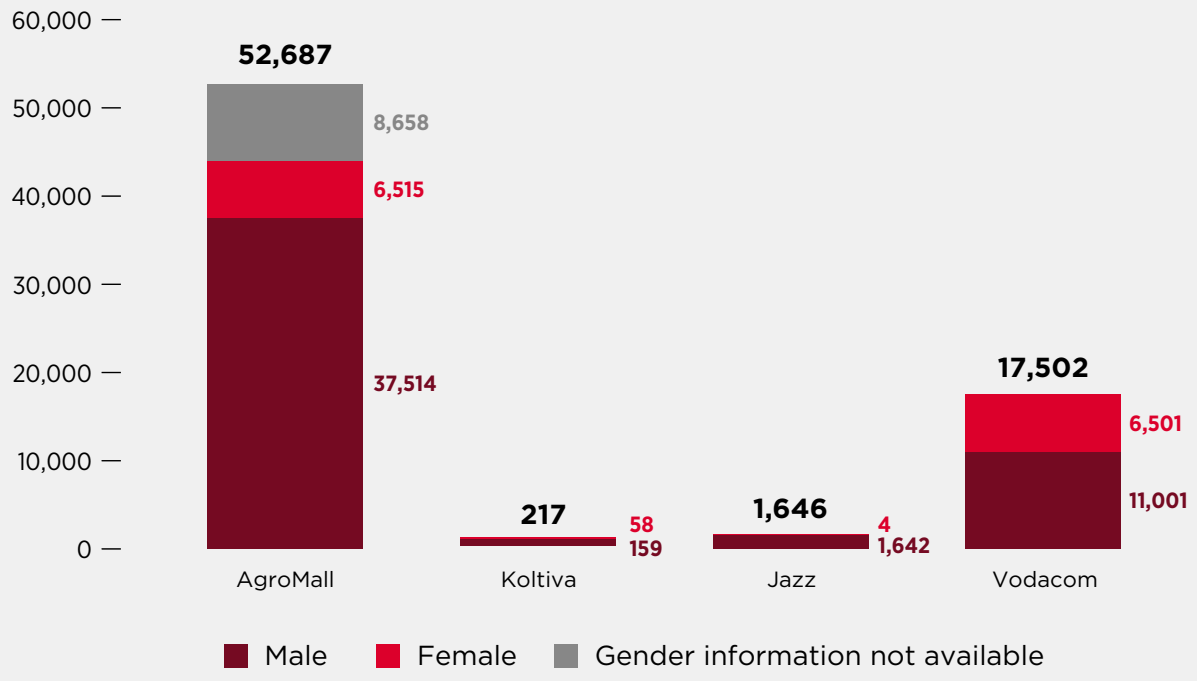
However, the delayed launch of loan services, given the difficulty of forming partnerships with FSPs, have meant that in-house loans have been slow to scale up. By October 2022, just 5% of registered farmers (72,052) had accessed a loan from a grantee. AgroMall has been spearheading loan provision across the portfolio, issuing 74% of the loans. While surveying non-users was outside the scope of the study, informal discussions with agribusinesses and farmers suggest that slow adoption could be a result of farmers perceiving their earnings as insufficient to either meet the loan eligibility criteria or repay the loan.

There is a significant gender gap in loan uptake, with women farmers 59% less likely to be loan users than men.[42] This gender gap is driven by low financial and digital literacy among women farmers, a lack of trust in formal FSPs, as well as social norms that require a husband's approval on a woman's loan application.[43] The gender gap in Nigeria is wider than in Tanzania compared to the gender distribution of profiled farmers. In Nigeria, 38% of women farmers with an AgroMall digital profile took out a loan compared to 54% of men who were profiled. Vodacom loan users represent a very small percentage of profiled farmers, but the gender gap is smaller, with 2% of profiled women farmers taking out a loan compared to 3% of profiled men. This is because Vodacom's digital self-registration model and mobile money-based service have made loans much more accessible and convenient for women. In contrast, AgroMall's agent-led model requires women to make loan requests through agents who are often male. This can be challenging as some women may not feel secure or at ease interacting with male agents. Additionally, in-kind repayment requires women to sell part of their harvest, which can be a hindrance.

42. 70% of total loans were issued to male farmers compared to 18% to female farmers.
43. CGAP. (14 December 2021). For AgroMall, Extending Credit to Women Requires First Convincing Men. CGAP Blog.

Figure 37
Number of farmers who have received a loan, by gender

BI Data



At the time this report was published, loans offered by AgroMall and Koltiva had not reached maturity, making it unfeasible to assess repayment. As for Vodacom and Jazz partner Reap Agro, which have shorter loan terms, default rates were low: 5% for Jazz and 3% for Vodacom. Jazz Reap Agro's low default rate is due to their in-kind repayment model and an emphasis on building long-lasting relationships with farmers. Reap Agro used a contract farming model with farmers who took out a loan and deducted the loan payments when they sold their harvest. Farmers valued the price stability of contract farming with a long-term buyer, which provided an incentive to repay loans on time to maintain a trusted relationship. Vodacom Songesha's low default rate is due to linking overdraft to mobile money accounts, which allowed them to make automatic deductions in the event of non-payment.

Figure 38
Technology, service design and business model considerations for loans

User feedback on digital loans

Feedback from farmers on the various loan products offered by GSMA Innovation Fund grantees is encouraging overall. Surveys show that farmers who received an input loan found that the application process was clearly explained (70% of surveyed farmers on average across Nigeria and Tanzania), easy to understand (71% of surveyed farmers) and the loan repayment process easy (68% of surveyed farmers).[44]

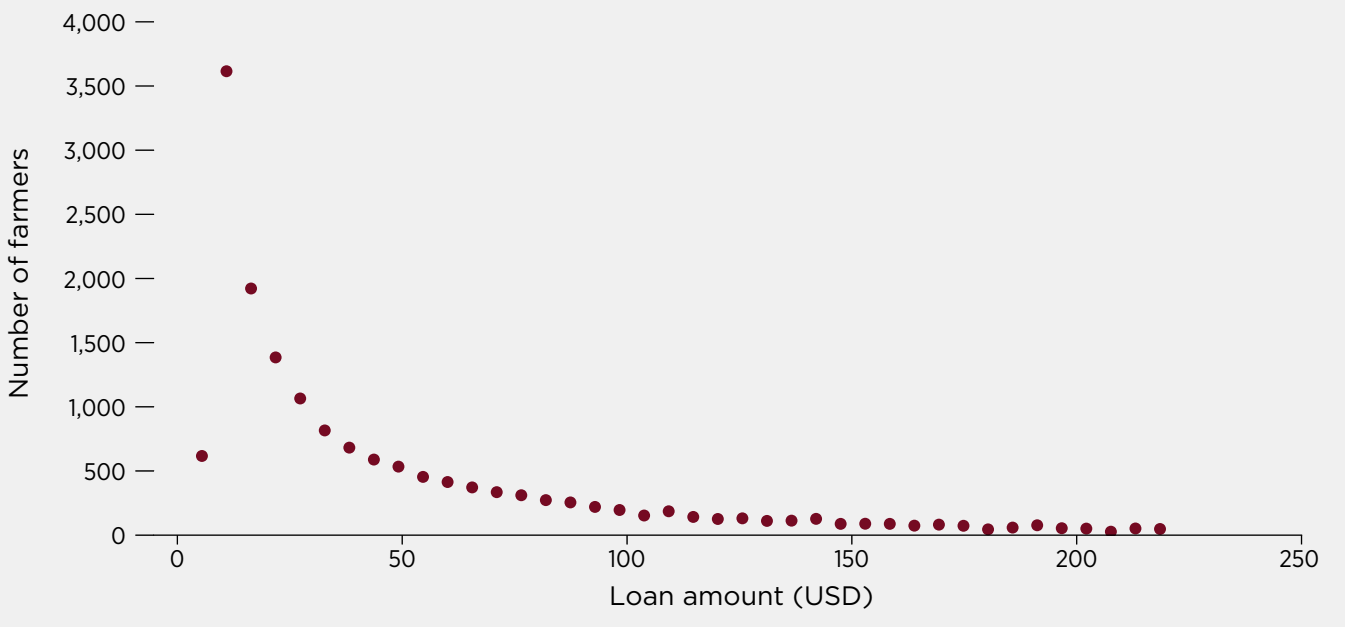
A comparison of AgroMall's input loan and the Vodacom overdraft service suggests that Vodacom's USSD application is clearer for farmers, as is the ease of repayment. In-kind input loans developed by grantees require farmers to rely on agents to request the loan, which gives them less agency and increases the risk of agent misbehaviour. In-kind input loans are also more prone to delays due to the logistics of acquiring and disbursing inputs. In-kind input loans create risks for providers because low-quality inputs can cause serious reputational damage, and in-kind repayments can be disputed by farmers when they believe the monetary value of their produce is underestimated, according to AgroMall. Another advantage of Vodacom's approach is that it is managed in-house so the process is much quicker than loans through third-party FSPs, especially since it is an automated process based on a farmer's overdraft history.

Farmer satisfaction with both models is lukewarm because inputs and overdraft amounts do not meet their financing needs. Only 49% of farmers strongly agree that they are accessing enough credit to meet their agricultural financing needs. Farmers have shared their appetite for larger loans and cash loans to hire labour or finance assets.

The input loans farmers receive are short term (up to one year) and align with agricultural cycles. For example, the loan product offered by Jazz's partner BKK matures in 4.5 months and AgroMall's input loan is seasonal to align repayments with the annual harvest season. Vodacom's Songesha overdraft service uses mobile money with a 30-day loan term. Most of Songesha's overdrafts are for low amounts: 61% of loans were for less than TZS 100,000 (around USD 40).[45] Overdraft amounts of more than TZS 500,000 (USD 214) represented just 8% of loans as of October 2022. These loan ticket sizes might not meet the financing needs of a large number of farmers and loan providers have a low appetite for risk and lending large sums to smallholders. Models should be refined to secure higher loan amounts while providing more guarantees for financial service providers.

Figure 39
Distribution of loan amounts of the Songesha overdraft product

BI Data



44. Monitoring survey results for Indonesia and Pakistan are not included as the sample sizes were too small.
45. Foreign exchange rate on 5 November 2022: USD/TZS=2,288.

Loan outcomes for agribusinesses and cooperatives

Digital profiling and procurement solutions enable agribusinesses and cooperatives to have more transparent loan processes. Transparent digital profiling and procurement systems reveal how much a farmer can repay and introduce more objective loan disbursements, rather than relying on the relationship between farmers and field agents.

Facilitating access to credit is highly valued by farmers and helps make cooperatives and agribusinesses more competitive. AgroMall loans have lower interest rates than those provided by input dealers or banks, making it an attractive offer that supports farmer acquisition. The cooperative NOMA, which uses AgroMall's bundle of procurement, advisory and loan services, believes that *"the major benefit of AgroMall's offer has been input loans"*.

Loan outcomes for grantees

For grantees that offer loans, facilitating access to inputs or capital strengthens their value proposition. Vodacom considers their Songesha service a success with smallholder farmers, as it scaled to 17,000 users within nine months after the service was integrated to M-Kulima in Q1 2022. They now aspire to make loan offerings the core business model and main selling point of M-Kulima. Vodacom's partnership with an MFI to offer loans that rely on farmer and farm data rather than traditional collateral is a first step in this direction.

Insurance

Four grantees have piloted weather-index insurance and area-yield index insurance to assess the viability of providing an insurance service to farmers.[46]

Insurance models

Since grantees did not have licences or the capacity to provide insurance in-house, they formed partnerships with insurance providers that would offer policies and underwrite risk. For Dialog, Jazz and Vodacom, the insurance offering was fully outsourced, with insurance providers leveraging the MNOs' pool of digitally profiled farmers to promote their crop insurance service. AgroMall partnered with an insurance provider to provide cover for inputs (seeds) that were delivered to farmers as part of their in-kind input loans offering. This latter model is a B2B relationship between AgroMall and their insurance partner and is not farmer-facing, as the cost of insurance is included in the value of the input loans.

Dialog and Jazz both contribute to the insurance model by providing rainfall weather data to their insurance providers to verify claims of crop damage caused by weather events.

46. For more information on the landscape of digital agriculture insurance, see: GSMA. (2020). Agricultural Insurance for Smallholder Farmers: Digital Innovations for Scale.

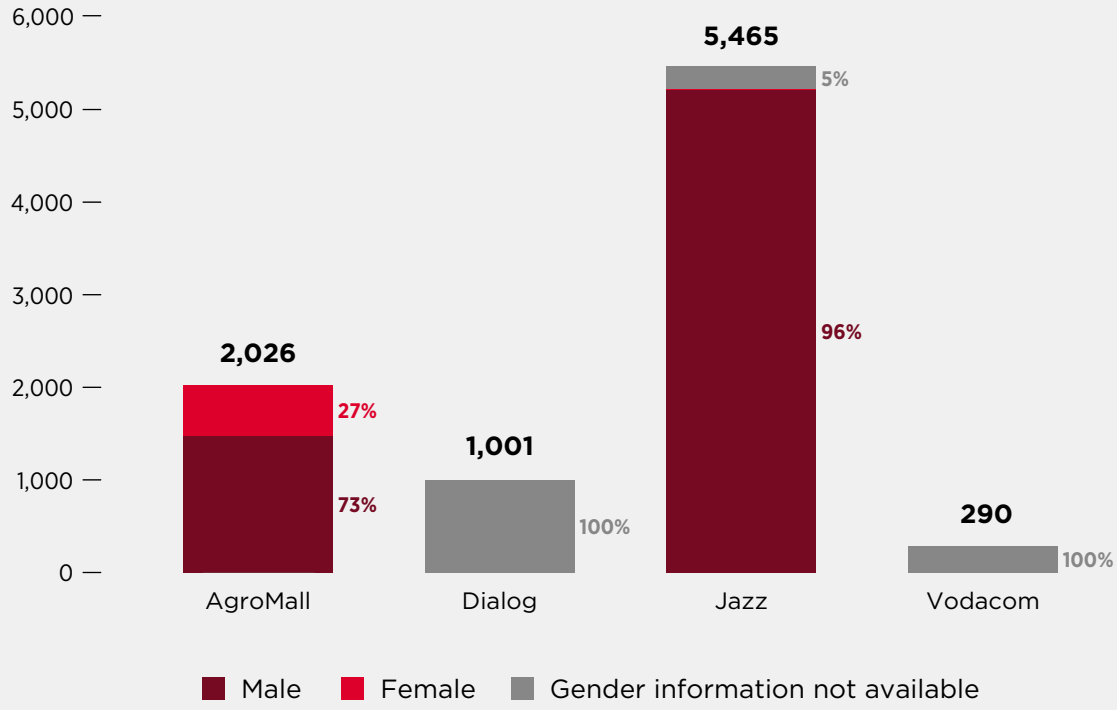
Uptake of insurance services

Insurance is a complex service that has been slow to develop and has slow uptake. Since insurance lies outside the core service offering of grantee MNOs and agritechs, they needed to form partnerships with insurance providers to offer services suited to smallholder farmers. In some markets, these providers are scarce.

Across the GSMA Innovation Fund portfolio, 8,782 farmers have been insured in Nigeria, Tanzania, Pakistan and Sri Lanka. Women account for just 6% of these farmers, which indicates they face significant barriers accessing insurance services. These barriers can include low capacity or control over their money to pay for the insurance premium, a lack of awareness or understanding of insurance and lower levels of trust in FSPs.[47] The gender gap is especially wide in Pakistan where 96% of policyholders were men, which is in line with the low proportion of women farmers profiled by Jazz and the low proportion of women who are heads of farming households in Northern Pakistan.

Figure 40
Insurance services uptake, by gender

BI Data

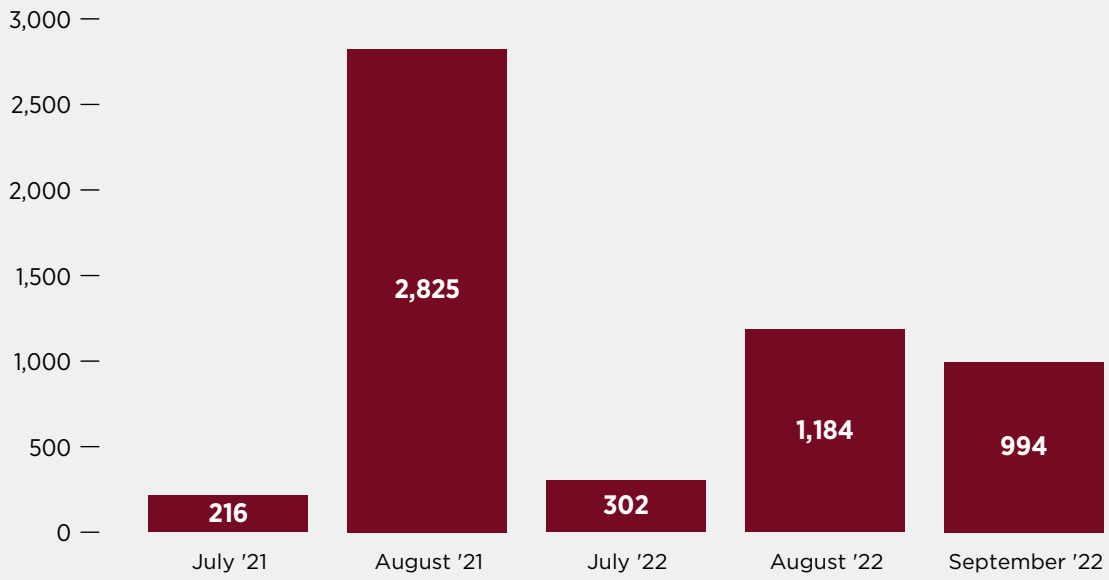


47. InsuResilience Global Partnership. (2018). Applying a Gender Lens to Climate Risk Finance and Insurance.

Jazz had the highest coverage of all grantees. To date, 5,465 farmers have taken out weather index insurance in Pakistan over two pilot coverage cycles, aligned with the start of the growing season, hence the annual peaks in August (see Figure 41). Despite 194 pay-outs due to heavy rainfall made during the first coverage cycle, there were no repeat users between the first and second cycle.

Figure 41
Number of farmers using the insurance service in Pakistan

BI Data



Insurance service design considerations

To expand coverage to their farmer base, several grantees decided to fully subsidise the cost of insurance or build it into a bundled product such as inputs. For example, the cost of insurance policies was borne by Dialog in Sri Lanka during pilots, and in Nigeria, AgroMall started insuring inputs sold to farmers. However, this resulted in many farmers being unaware they were insured. Similarly, after their weather index insurance pilot phase, Reap Agro in Pakistan shifted to bundling crop insurance with in-kind input loans.

User feedback on insurance

Samples sizes for insurance users were very small at the time of data collection, preventing a full analysis of farmer feedback on insurance.[48] Some feedback on insurance emerged in qualitative interviews with farmers.

Insurance is a difficult sell because the value proposition for farmers is uncertain when weighed against the insurance premiums. Although farmers understand the value proposition of insurance, especially after suffering from heavy rains or pest infestations, such as in Pakistan or Tanzania, insurance premiums and lack of trust in insurance companies are key barriers to adoption.

> "I don't really trust insurance. It is an additional cost for us. We can't pay a lot of money for insurance."
>
> **Sri Lankan farmer, male, 75 years old**

> "There was a meeting organized by Reap Agro where they talked to us about crop insurance, but right now I can't afford to pay the insurance premium."
>
> **Pakistani farmer, male, 56 years old**

Insurance for smallholder farmers requires strong partnerships with insurance providers that have the capacity to underwrite microinsurance products, as well as additional testing of user journeys and raising awareness among smallholder farmers. Organisations working in the agricultural last mile need support to better understand insurance and the business model, as this will help them develop customer journeys adapted to smallholder farmers and view insurance as a key service offering.

48. N = 17 in monitoring surveys.

2.3 Perceived impact on incomes and climate resilience

The GSMA Innovation Fund aims to generate impact through digital services, particularly on the incomes and climate resilience of smallholder farmers.

This section focuses on the extent to which digital solutions were perceived by farmers as having increased their incomes and strengthened their climate resilience. Seasonal harvests and the delay of service launches due to COVID-19 limited repeat usage of some services and prevented the analysis from including an assessment of the sustainability of these perceived benefits over time. The assessment provides an early indication of the perceived impact of digital solutions and relies on data from quantitative surveys of 2,114 farmers and 53 qualitative interviews with farmers.

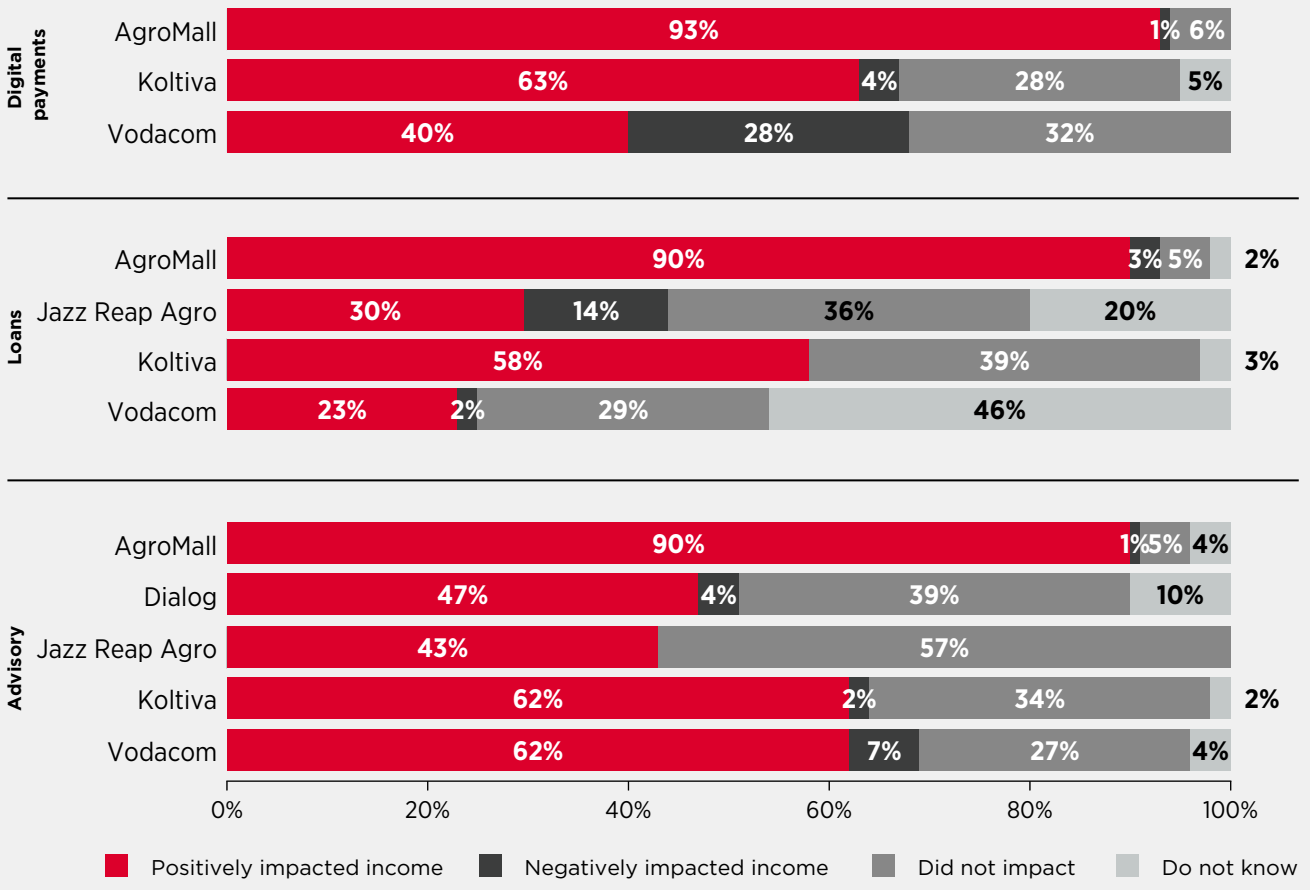
2.3.1 Perceived contribution of digital agriculture solutions to farmer incomes

Digital solutions leading to higher incomes

This section explores the impact of digital advisory, loans and payments on the incomes of smallholder farmers as perceived by smallholder farmers themselves.

Outcome studies

Figure 42
Perceived impact of digital services on farmer incomes[49]
(N=1,494)[50]



49. Digital procurement was not tested against increased income as it is not a farmer-facing service.
50. N= Advisory: 654; Loans: 566; Payments: 274.

Comparisons between grantees and countries should be made with caution as the impact of services is based on farmers' perceptions, which are influenced by factors such as digital literacy and past access to services. Farmers in AgroMall's customer base have consistently high perceptions of digital services contributing to income. These farmers are predominantly smallholders with low incomes who did not have access to digital services prior to the project.

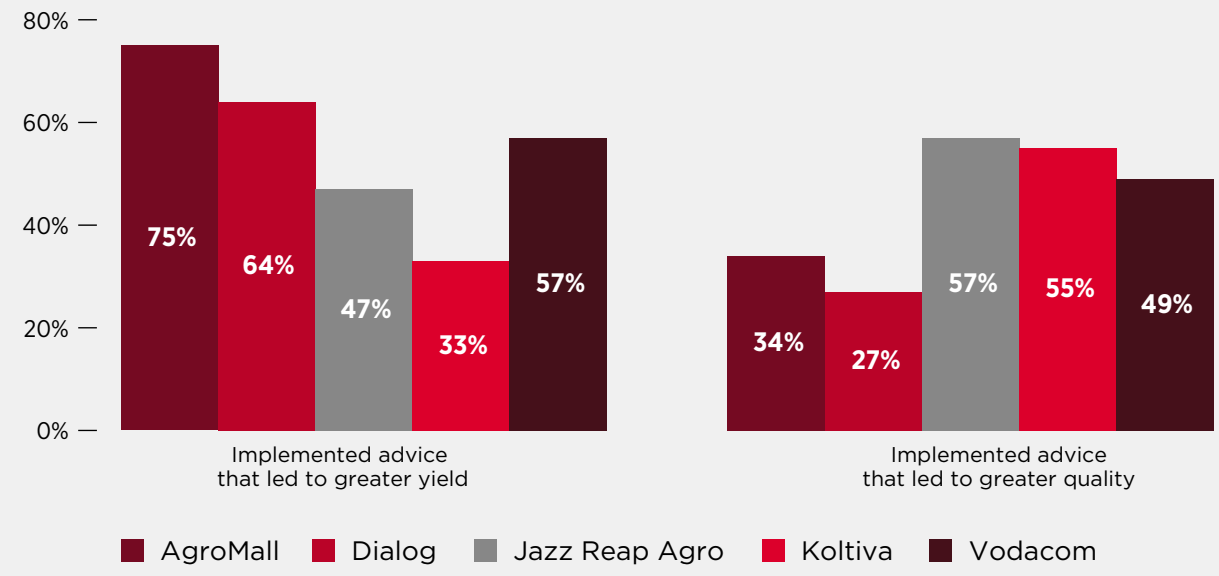
Lower perceived contributions to income for Dialog in Sri Lanka and Jazz Reap Agro in Pakistan can be explained by challenging economic contexts at the time of the GSMA Innovation Fund. Finally, Vodacom's loan and payment users are mobile money users and include a lower proportion of smallholder farmers, which might limit the contribution of digital services to their incomes.

Digital advisory

Of all the solutions developed by grantees, digital advisory is perceived as the single biggest contributor to increased income. Farmers linked their use of digital advisory and the implementation of agronomic advice with increased income from higher yields and crop quality.

Figure 43
Reasons farmers reported an increase in income from using digital advisory
(N=712)[51]

Outcome studies

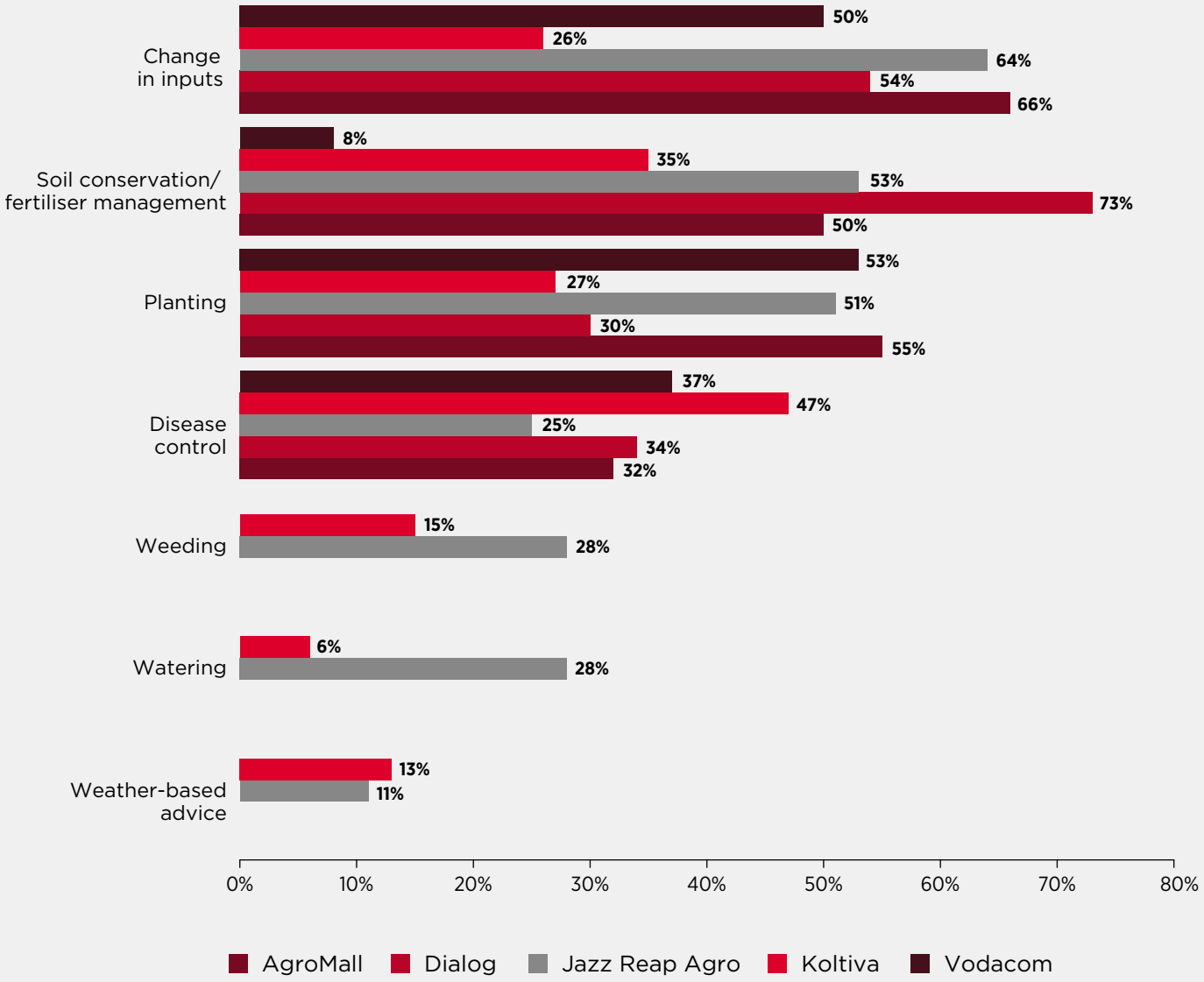


The link between crop quality and increased income is stronger in markets where produce is sold at grade-based prices or when produce must meet certain criteria. For example, Reap Agro in Pakistan sells potatoes to processors that require specific moisture and sweetness content, and 57% of their digital advisory users said they had increased the quality of their crop and had fewer rejections after implementing agronomic advice. Koltiva in Indonesia provides certification schemes with associated agronomic advice for cocoa farmers through which they receive premium bonuses based on produce quality. Of the certified cocoa farmers surveyed in Indonesia, 92% say Koltiva encourages them to implement the right practices to be a certified farmer, and 58% believe that being certified has helped raise their income. Of these farmers, 52% stated that they can sell their cocoa at a higher price and 44% stated that the certification requirements pushed them to increase their productivity and quality.

Of the farmers who perceived that digital advisory increased their income, advice on input and fertiliser management, planting and disease control are believed to have the greatest impact.

51. N= AgroMall: 347; Dialog: 132; Jazz Reap Agro: 53; Koltiva: 69; Vodacom: 111.

Figure 44
Implemented advice from digital advisory that contributed to increased incomes (N=689)[52]



> "The M-Kulima SMS urged me to use the line method for my farming. I was able to save about 10 kg of seeds from my two acres and also increase my yield."
>
> **Tanzanian farmer, male, 53 years old**

Digital advisory has the potential to address the safety and harassment issues women farmers traditionally face during in-person interactions with male agents. This is a key barrier, according to a qualitative gender study with Tanzanian farmers. Digital advisory provides a way for women farmers to learn new farming skills and empower themselves independently.

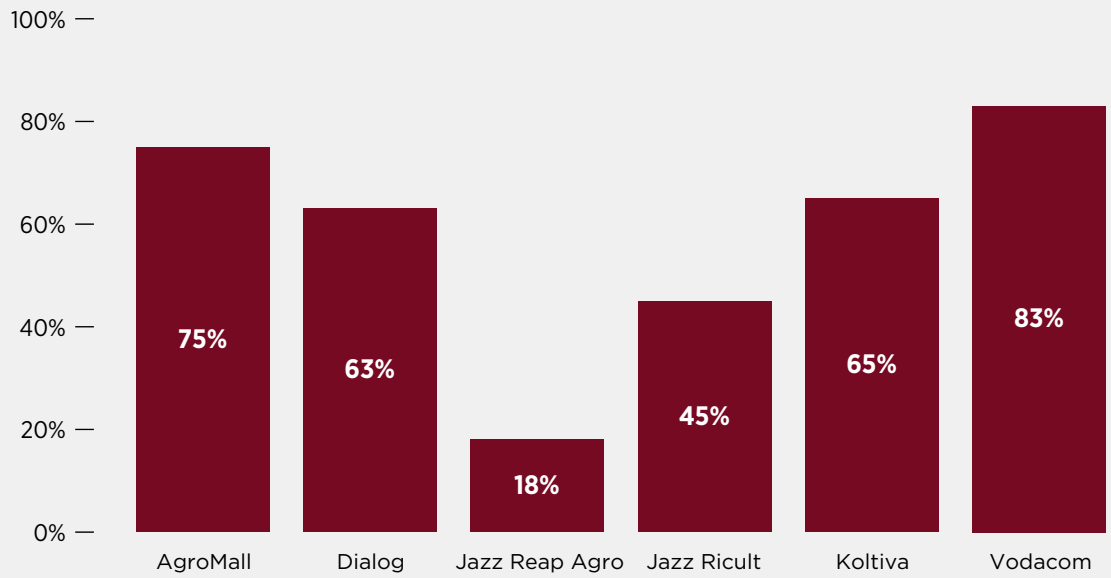
> "All the SMS are sent through my phone and I can simply access them without interacting with anyone."
>
> **Tanzanian farmer, female, 31 years old**

However, barriers to digital inclusion can also prevent women farmers from reaping the benefits of digital advisory. In settings where household members share a mobile phone, women can find it difficult to access digital advisory as they are often not the primary phone user. Monitoring and evaluation surveys indicate that, on average, 58% of married male farmers who are registered as the primary digital advisory user share the advice they receive with their spouses, with men in Nigeria and Tanzania sharing the most.

52. N= AgroMall: 347; Dialog: 116; Jazz/Reap Agro: 53; Koltiva: 62; Vodacom: 111.

Figure 45
Percentage of married male advisory users who share agronomic advice with their spouse
(N=1,668)[53]

Monitoring surveys



While these results indicate that digital advisory can reach farmers at a household level and benefit women who are not the primary advisory user, the spill-over benefits do not always reach female spouses when men are the primary registered user. Even when women farmers own a mobile phone and are registered to advisory services themselves, their phone usage might be restricted. For example, some women have reported that their husbands will delete SMS advice received on the phone as they perceive it as coming from untrustworthy sources.

> "My husband has signed up for this service for many crops. My husband listens to the messages most of the time and shares the information with me. I also listen to them sometimes. The phone is often used by my husband and I am mostly busy plucking tea, so my husband listens to the calls."
>
> **Sri Lankan farmer, female, 48 years old**

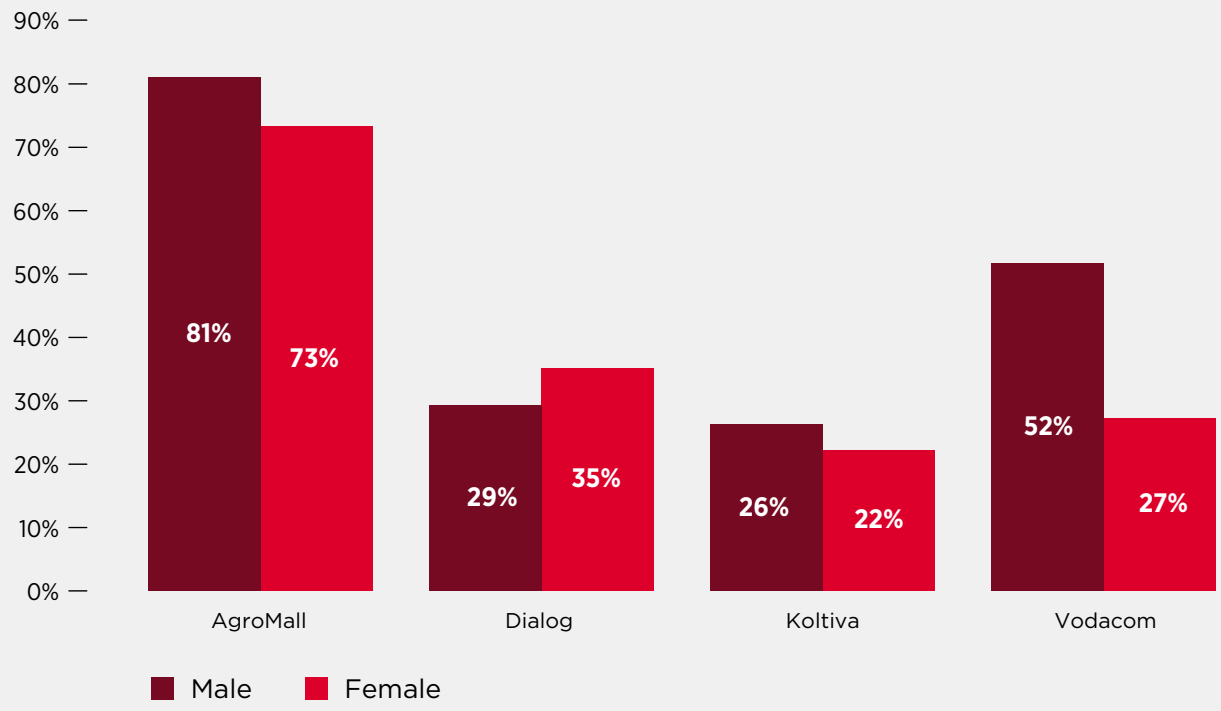
> "My husband likes to take my phone and inspect it occasionally and if he finds any weird messages, even if they are advisory, he deletes everything."
>
> **Tanzanian farmer, female, 49 years old**

These barriers to usage might explain why **the perceived contribution of digital advisory to increased income varies between men and women across markets**. Men in Nigeria, Tanzania and Indonesia are, overall, more likely to link advisory to higher incomes. Sri Lanka is the only market where women farmers associated advisory with an increase in income more than men. The Govi Mithuru OBD/IVR service developed in 2015 is the most mature of all digital advisory services supported by the GSMA Innovation Fund. Dialog's advice is more tailored compared to AgroMall and Vodacom's SMS-based advisory, and Sri Lanka's tea value chain has strong female participation compared to other markets. All these factors might explain why women farmers in Sri Lanka were more likely to link advisory with an increase in income.

53. N= AgroMall: 400; Dialog: 318; Jazz Reap Agro: 200; Jazz Ricult: 200; Koltiva: 150; Vodacom: 400.

Outcome studies

Figure 46
Percentage of farmers who perceived a contribution of digital advisory to increased income, by gender
(N=927)[54]



Key takeaways

Farmers perceive digital advisory services as the most consistent contributor to increased income. Agronomic advice helps improve input and fertiliser use and planting techniques that lead to higher yields. In markets where agricultural produce is graded, advisory can help farmers improve crop quality and ultimately receive a higher price.

54. AgroMall N=71 female, 279 male; Vodacom N=22 female, 149 male; Dialog N=91 female, 208 male; Koltiva N=27 female, 80 male.

Loans

Loans are associated with increased incomes for 50% of surveyed farmers across Nigeria, Indonesia, Pakistan and Tanzania. However, the link between loans and income varies widely between markets, in part because of the nature of the loans provided and the local economic context.

Input loans are critical for farmers when cash flow is low, and they also help them gain access to better quality inputs that improve productivity and yield. During in-person qualitative interviews with 32 farmers in Indonesia, Nigeria and Pakistan, all farmers shared the positive impacts of their input loans, citing yield and cash flow.

> "[Input distribution] has impacted me because in the past we had to weed our farms ourselves but now with the help of the herbicide we do not stress ourselves like we used to. The fertiliser also makes our yield grow significantly."
>
> **Nigerian farmer, female, 20 years old**

Access to timely and quality inputs was cited by farmers as a key determinant of income changes. The introduction of an inorganic fertiliser ban in Sri Lanka in April 2021 is a clear example of the role inputs play in farmer incomes.[55] Lack of access to inputs led to decreased productivity for farmers who could not afford organic fertiliser. When the fertiliser ban was lifted in November 2021, the country was in the grip of an economic crisis and fertiliser prices rose, leaving farmers unable to afford it.[56] Incomes dropped for most surveyed farmers (76%), with 86% attributing it to lack of access to fertiliser, regardless of tea prices.

> "In the last two years and until recently, income was very low. Since the government banned fertilisers, the production of tea leaves has decreased. However, we are now getting a very good price for the tea leaves and income has increased in the last two or three months but productivity has decreased considerably due to lack of fertiliser."
>
> **Sri Lankan farmer, male, 75 years old**

The nature of in-kind input loans relieves farmers of high cash outlays for inputs, allowing them to save or redirect their finances to other needs. A small percentage of farmers in Pakistan indicated that they redirected the money they would have used to purchase inputs to invest in things that would help them grow their farm (13%) or to pay for household needs (39%).

> "The input loan has helped me a lot. It reduces part of my financial burden. By having access to input loans, I can save money and use it for other needs. If the input loan could also address other needs of farmers such as pesticides, farming tools, etc. it would help them more."
>
> **Indonesian farmer, male, 40 years old**

The impact of loans was less clear in economically strained markets such as Pakistan. Here, high levels of inflation and catastrophic flooding[57] have caused input prices to rise and, despite receiving input loans, farmers have not seen their income rise.

> "Due to this inflation, we are unable to invest in our farms and as a result our productivity is going down drastically."
>
> **Pakistani farmer, male, 45 years old**

> "Inputs on credit help us increase productivity. Many farmers stopped using fertilisers because of high prices, which led to a decrease in their productivity. Since we are working with BKK and getting inputs on credit, we can counter this inflation."
>
> **Pakistani farmer, male, 32 years old**

Across grantees, only a small percentage of farmers perceived loans as having a negative impact due to interest and default payments. Four percent of surveyed farmers in Nigeria, 14% in Pakistan and 2% in Tanzania perceived that the services contributed to a decrease in their income.

The perceived contribution of digital loans to increased income is lower for the overdraft service provided in Tanzania than for input loans. Only 23% of surveyed farmers reported that Songesha had increased their income while 75% were unsure about the impact of the overdraft service. This is because many overdraft limits were so low that they did not meet farmers' financing needs or qualify as loans. According to BI data, 78% of Songesha overdrafts were less than USD 5, the minimum amount a farmer would need to make basic farming-related purchases such as seeds. According to a survey with Songesha users, the overdraft was used for many purposes, including to purchase agri-inputs (34%), pay for airtime (24%), withdraw cash (21%), send money (21%) and pay bills (20%).

55. Time. (13 July 2022). "The Crisis in Sri Lanka Rekindles Debate Over Organic Farming".
56. The Guardian. (22 June 2022). "Sri Lanka's prime minister says economy has 'completely collapsed'".
57. World Bank. (6 October 2022). "World Bank: Pakistan's Economy Slows Down While Inflation Rises Amid Catastrophic Floods".

Key takeaways

Input loans have a direct positive impact on farmer incomes by improving access to inputs or better-quality inputs, both of which are vital to boosting yields. When loans are smaller, farmers are less likely to perceive them as contributing to increased income, and point to financing needs beyond inputs that require broader loan offerings, such as paying for labour and investing in mechanisation.

Digital payments

Digital payment models vary between grantees. AgroMall in Nigeria and Koltiva in Indonesia give agribusinesses and cooperatives the option to pay farmers with e-wallet transfers linked to bank accounts. Vodacom and MTN[58] integrated their M-Pesa and MoMo mobile money services in Tanzania and Rwanda as payment options for cooperatives (see the payment models section for more details).

Farmers who receive e-wallet transfers linked to their bank accounts perceived digital payments as a bigger contributor to increased income than getting paid in cash. These results should be interpreted with caution for AgroMall, however, as farmers received an NGN 20,000 (around USD 46)[59] sign-up bonus to open an e-wallet.

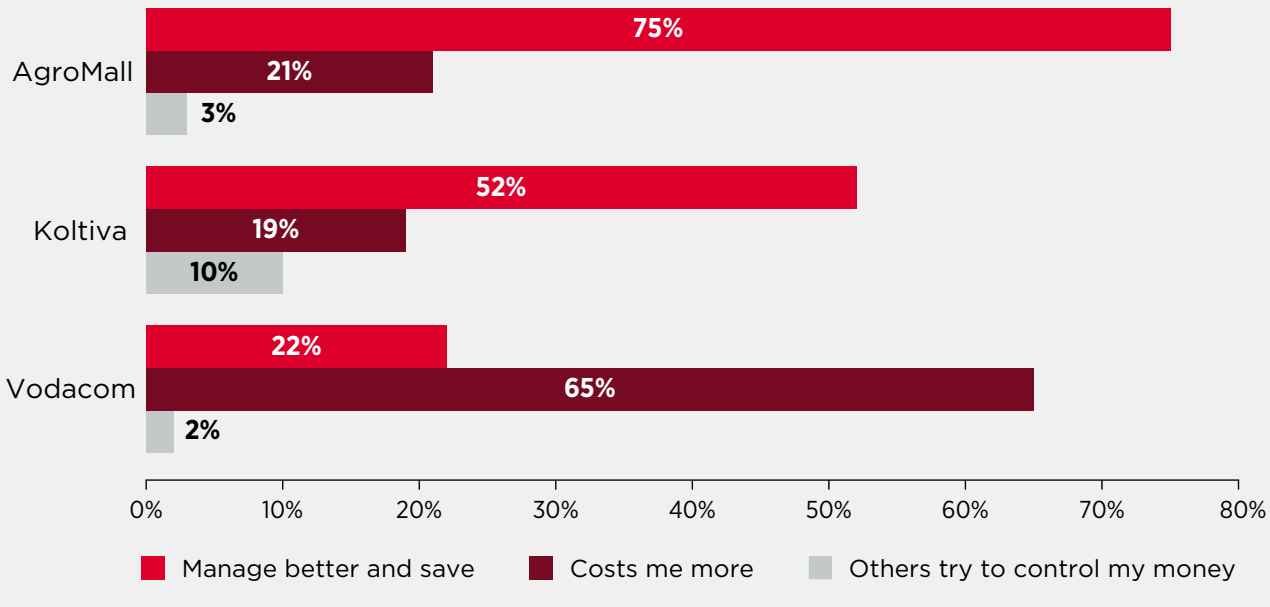
Transaction costs were cited as the main contributor to decreased income by 35% of users on average across markets. The link between mobile money transaction costs and lower incomes was especially strong in Tanzania where it was mentioned by 65% of users after the the government levy on mobile money was introduced.[60] This clearly illustrates the negative impact of levies on digital payments for lower income users, who tend to be more price sensitive and make smaller transactions. For these users, fees account for a greater percentage of the total transaction than for a higher income user.

Outcome studies

Figure 47

Perceived impact of digitial payments on farmer incomes

(N=432)[61]



58. Sample sizes were very low for MTN mobile money users at the time of the survey, therefore, only qualitative insights from in-person interviews are presented for MTN mobile money users.
59. Foreign exchange rate on 6 September 2022: USD/NGN=427.26.
60. The levy was lifted in September 2021. For more details on the levy, see: GSMA. (2022). State of the Industry Report on Mobile Money.
61. N= AgroMall: 94; Koltiva: 63; Vodacom:59; Total: 216.

Despite the negative impact of transaction costs, digital payments were largely perceived as a positive contribution to farmer incomes in Nigeria, Indonesia and Rwanda, where 50% of digital payment users reported they were better able to manage and save money.

> "I always received tea payment via mobile money because this used to help me to never spoil money and waste it on unplanned things."
>
> **Rwandan farmer, male, 58 years old**

During in-person interviews, some farmers mentioned time savings and safety as positive, non-monetary impacts of digital payments compared to cash.

> "Being paid digitally has impacted me positively in how I conduct my farming activities. I get paid via my account and can be paid cash too, but I prefer via my account. Receiving my payment via my bank account [through the wallet] motivates me to farm more because I know my money is secure."
>
> **Nigerian farmer, male, 32 years old**

> "In our village e-payments [...] are safer and help a farmer avoid extravagant spending. They can be useful to me because they are confidential and therefore safer."
>
> **Tanzanian farmer, female, 42 years old**

Quantitative surveys found no evidence that women farmers perceive digital payments as more detrimental to their financial independence than cash. However, in-person interviews with women farmers highlighted structural and normative barriers to accessing and using digital payments and subsequent improvements in control over their money. Barriers included SIM ownership and control over the use of mobile phones.

> "The phones were bought by our husbands and also the SIM cards were registered by them. Our husbands have the full rights on our phones including M-Pesa passwords. Sometimes our husbands take the phone, use it for up to a week and when we want it back we have to ask permission, even though they are supposed to be ours."
>
> **Tanzanian farmer, female, 50 years old**

> "I own a phone that my husband bought, but I have very strict restrictions to use it. My husband can have access to it anytime he wants for as long as he wants. He knows my mobile money account password as well."
>
> **Tanzanian farmer, female, 52 years old**

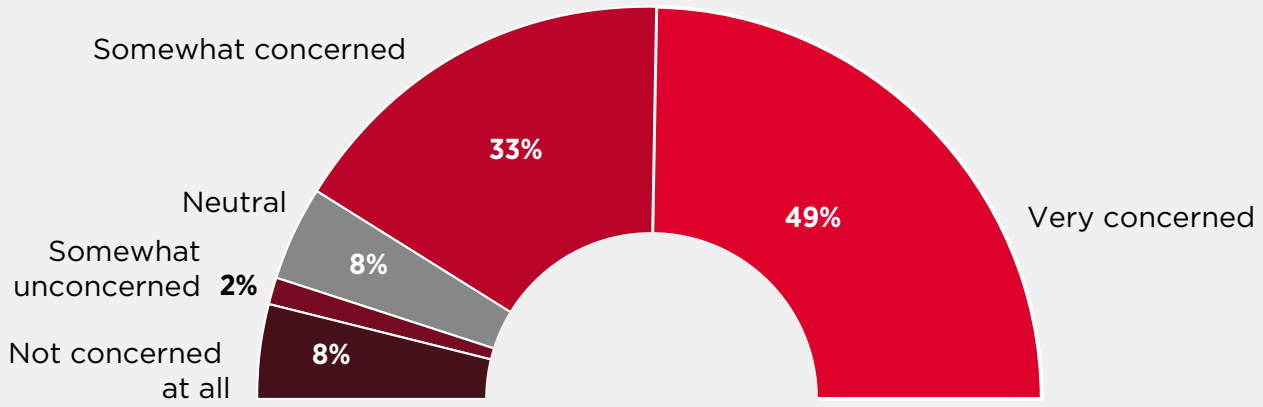
Key takeaways

While farmers perceive digital payments as having positive impacts, from better money management to safety and time savings, smallholder farmers remain price sensitive and associate transaction costs with decreased income. Higher costs, for example following levies, outweigh the positive impacts of digital payments. Women farmers face social barriers to accessing and using digital payments which prevent them from reaping the potential benefits, including having more control over their money.

2.3.2 Perceived contribution of digital agriculture solutions to farmer climate resilience

Most surveyed farmers expressed some concern about the impact of weather and climate shocks on their livelihoods and their farms, with only 18% unconcerned or neutral about changing weather patterns.

Figure 48
Percentage of farmers concerned about weather and climate shocks affecting themselves and their farm
(N=2,114)[62]



Farmers are aware of the direct impact of weather patterns on yield and income:

> "Weather conditions have some impact. When it is very windy, the yield is low, and it takes time for the leaves to grow properly. When the weather is too hot, the trees start to die. When there is too much rain, the amount of leaves is also less. We need a balanced weather for tea."
>
> **Sri Lankan farmer, female, 63 years old**

> "The climate season is no longer the same as it was in the previous years. We farmers used to experience heavy rains that helped us plant our crops in time and have good harvests. These days there are shorter rain seasons and dominant drought seasons."
>
> **Tanzanian farmer, male, 60 years old**

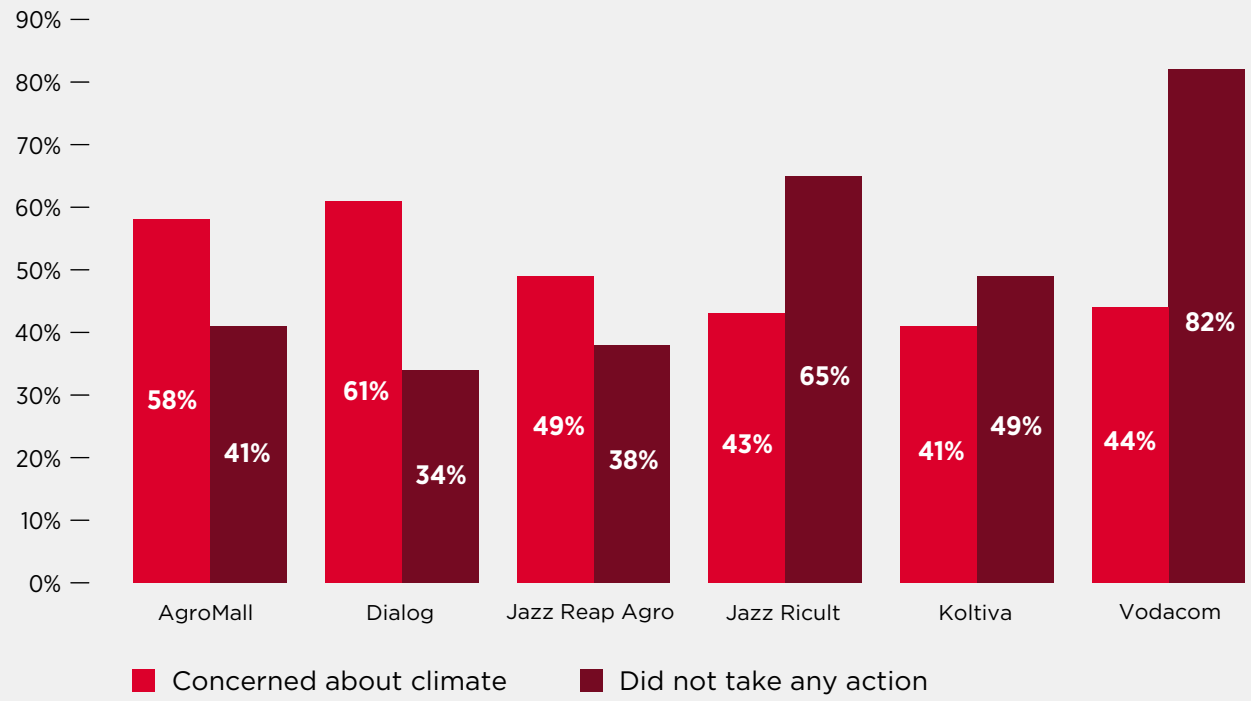
Yet, there is a discrepancy between farmers being concerned about climate and taking steps to prepare for climate- and weather-related events. Farmers show signs of disempowerment, often citing that the weather and climate are beyond their control.

> "The farmers in this area are very modest, they think that everything comes from God Almighty and that they can't do anything about it."
>
> **Pakistani farmer, male, 32 years old**

62. N= AgroMall: 500; Dialog: 308; Jazz Reap Agro: 250; Jazz Ricult: 254; Koltiva: 302; Vodacom: 500.

Figure 49
Percentage of farmers concerned about climate versus percentage of farmers who have not taken any action to prepare for climate events
(N=2,114)[63]

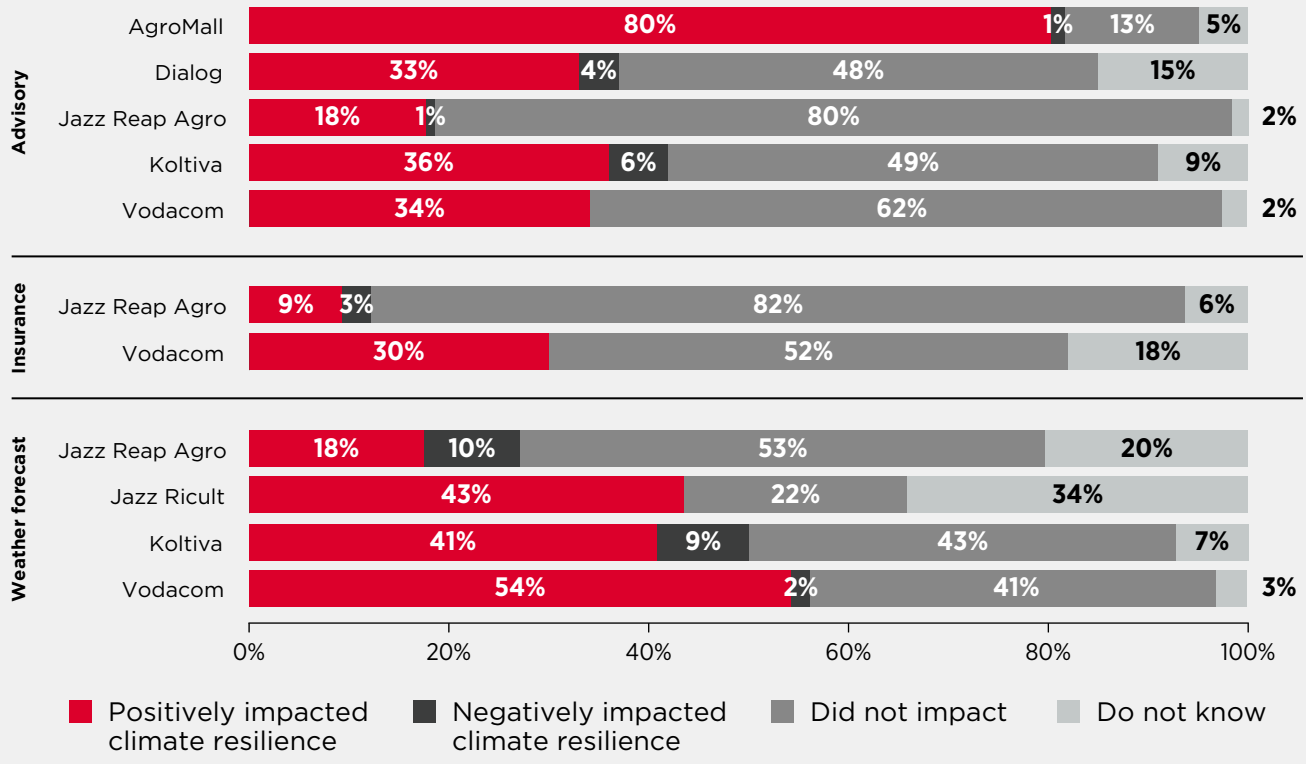
Outcome studies



When prompted about specific digital services that could help improve their climate resilience, 47% of farmers pointed to digital advisory and 43% to weather forecasts.

Figure 50
Perceived contribution of digital services to climate resilience
(N=2,685)[64]

Outcome studies

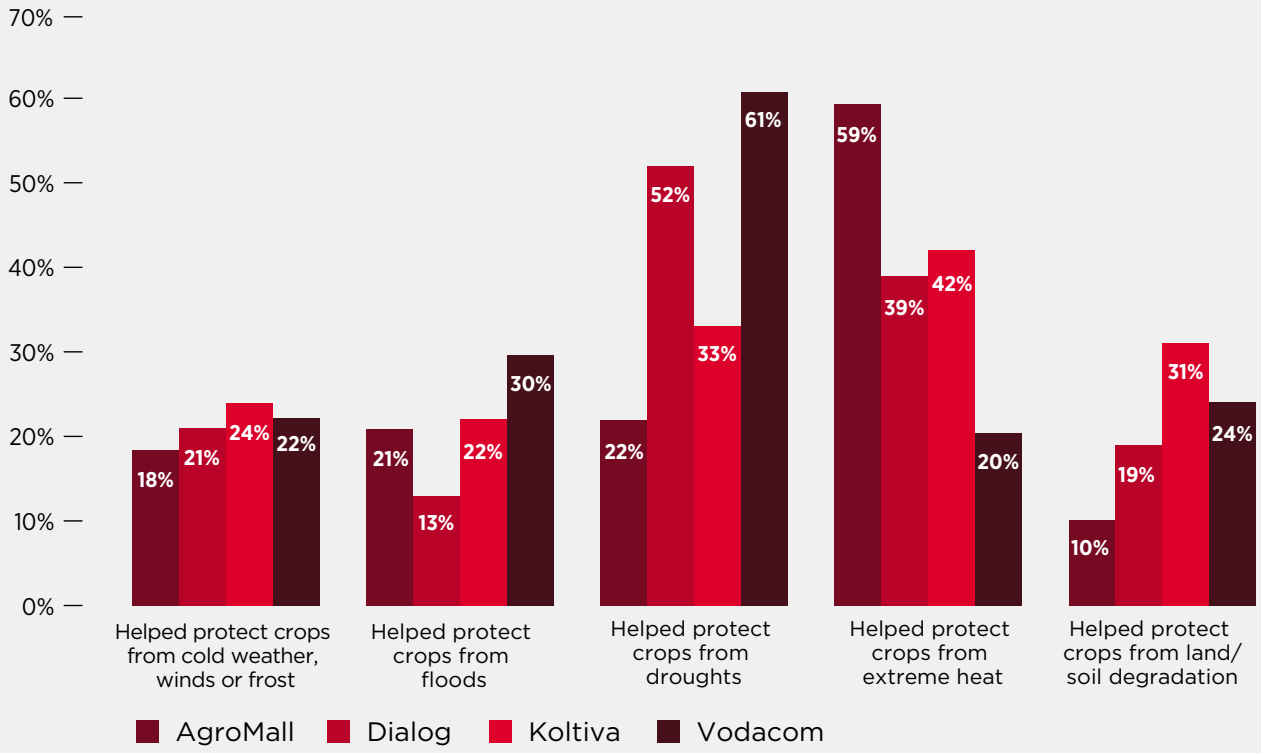


63. N= AgroMall: 500; Dialog: 308; Jazz Reap Agro: 250; Jazz Ricult: 254; Koltiva: 302; Vodacom: 500.
64. N= Digital advisory: 1,004; Insurance: 122; Weather forecasts: 1,559.

Farmers link digital agronomic advisory with the ability to be better prepared for weather events, including extreme heat and droughts, while they perceive weather forecasts as useful for anticipating short-term and future weather events.

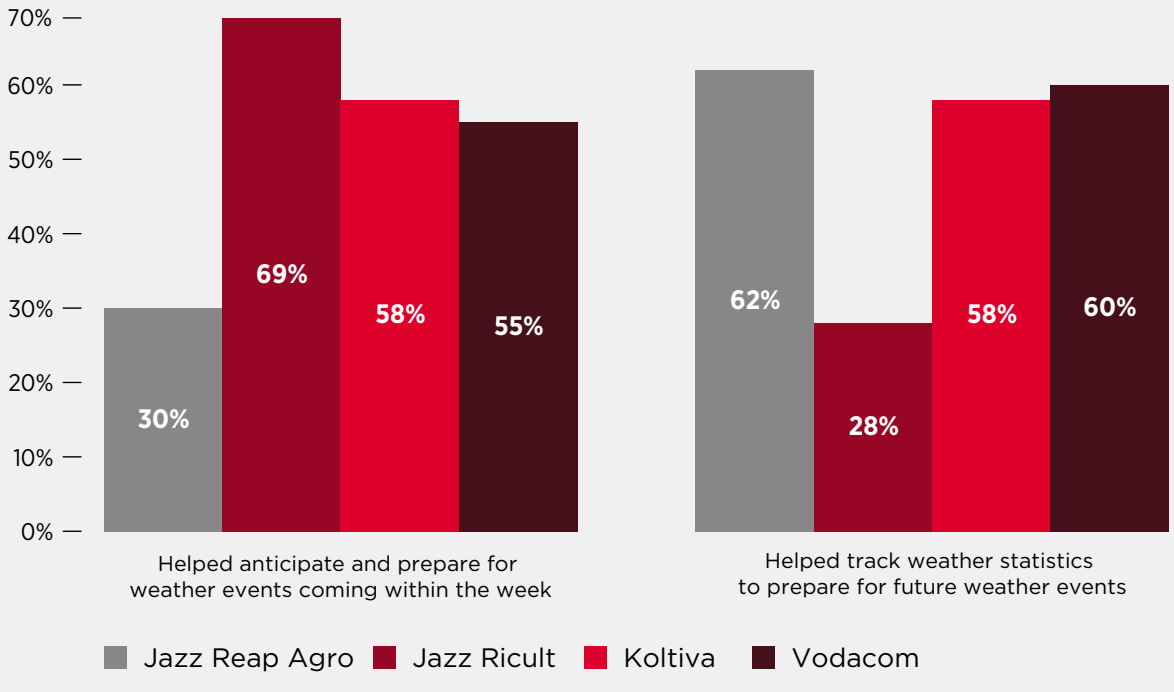
Outcome studies

Figure 51
Perceived contribution of digital advisory to climate resilience
(N=487)[65]



Outcome studies

Figure 52
Perceived contribution of weather forecasts to climate resilience
(N=294)[66]



65. N= AgroMall: 278; Dialog: 11; Koltiva: 45; Vodacom: 54.
66. N= Jazz Reap Agro: 63; Jazz Ricult: 75; Koltiva: 83; Vodacom: 73.

"With the weather SMS I can choose which crops I want to plant on my farm depending on the expected amount of rain. That way at least I have been able to manage with the other crops that can handle the climate changes."

Tanzanian farmer, male, 60 years old

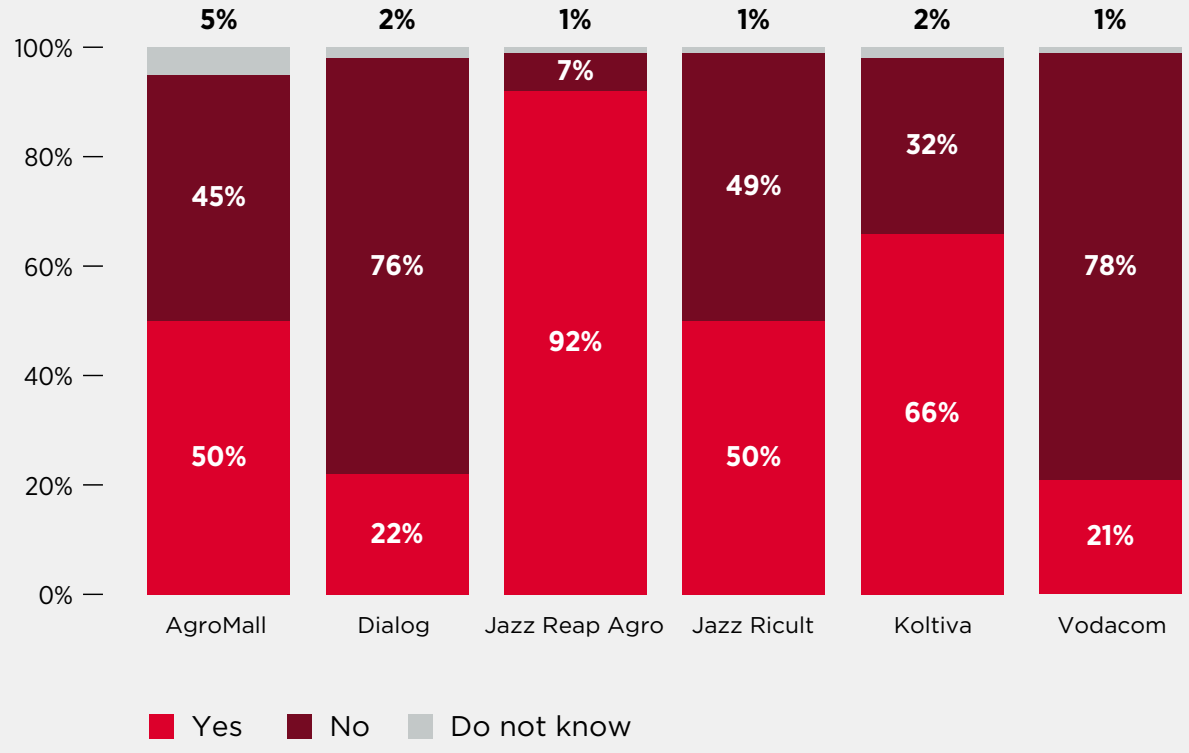
"I used to track the weather via the Android app of my smartphone but now I do it from the BKK app. This app gives us accurate local information, while the Android app provides a broader picture."

Pakistani farmer, male, 24 years old

Farmers placed more emphasis on adapting farming practices and accessing weather forecasts to improve their climate resilience than on financial safety nets. On average, 48% of surveyed farmers did not believe that an increase in income would make them less concerned about climate shocks, with no observed differences between genders or age groups.

Outcome studies

Figure 53
Percentage of farmers who believe that increased income would make them less concerned about climate shocks
(N=2,114)[67]



While insurance services were relatively new at the time of the survey and few farmers had received a pay-out, the perception that insurance contributed to climate resilience was limited. Only 9% of insurance subscribers in Pakistan and 30% in Tanzania perceived that insurance directly contributed to improving their climate resilience.

Key Takeaways

Digital advisory services and weather forecasts show potential to improve the climate resilience of smallholder farmers. More efforts are needed to raise awareness of the financial mechanisms available to mitigate financial shocks related to climate events.

67. N= AgroMall: 500; Dialog: 308; Jazz Reap Agro: 250; Jazz Ricult: 254; Koltiva: 302; Vodacom: 500.

Perceived impact of digital services on farmers with disabilities

Outcome studies

Monitoring surveys

There is limited evidence of the perceived impact of digital services on farmers with disabilities, due to very low sample sizes across services. In monitoring surveys, farmers with disabilities[68] showed consistently lower production volumes and were consistently less likely to recommend digital services than farmers without disabilities. Farmers with disabilities represented 5% (99 farmers) of those surveyed for outcome studies across the portfolio.[69] The main disabilities reported were impaired vision and hearing.

While sample sizes are small, survey findings suggest that farmers with disabilities have a stronger perception that advisory services contribute to increased income. 60% of farmers with disabilities (28 out of 46) perceived that advisory services lead to increased income compared to 53% of farmers without disabilities. Perceptions of the value of digital advisory were higher in Nigeria, Pakistan and Tanzania. On average, farmers with disabilities were less likely to link weather forecasts with climate resilience than farmers without disabilities.

68. 206 farmers across the three waves of monitoring surveys, equivalent to 4% of the total sample.
69. Based on the Washington Group Short Set of questions on Functioning (WG-SS). Those with *"a lot of difficulty"* doing a given function or *"cannot do at all"* are considered to have a disability.

3 Lessons from the GSMA Innovation Fund

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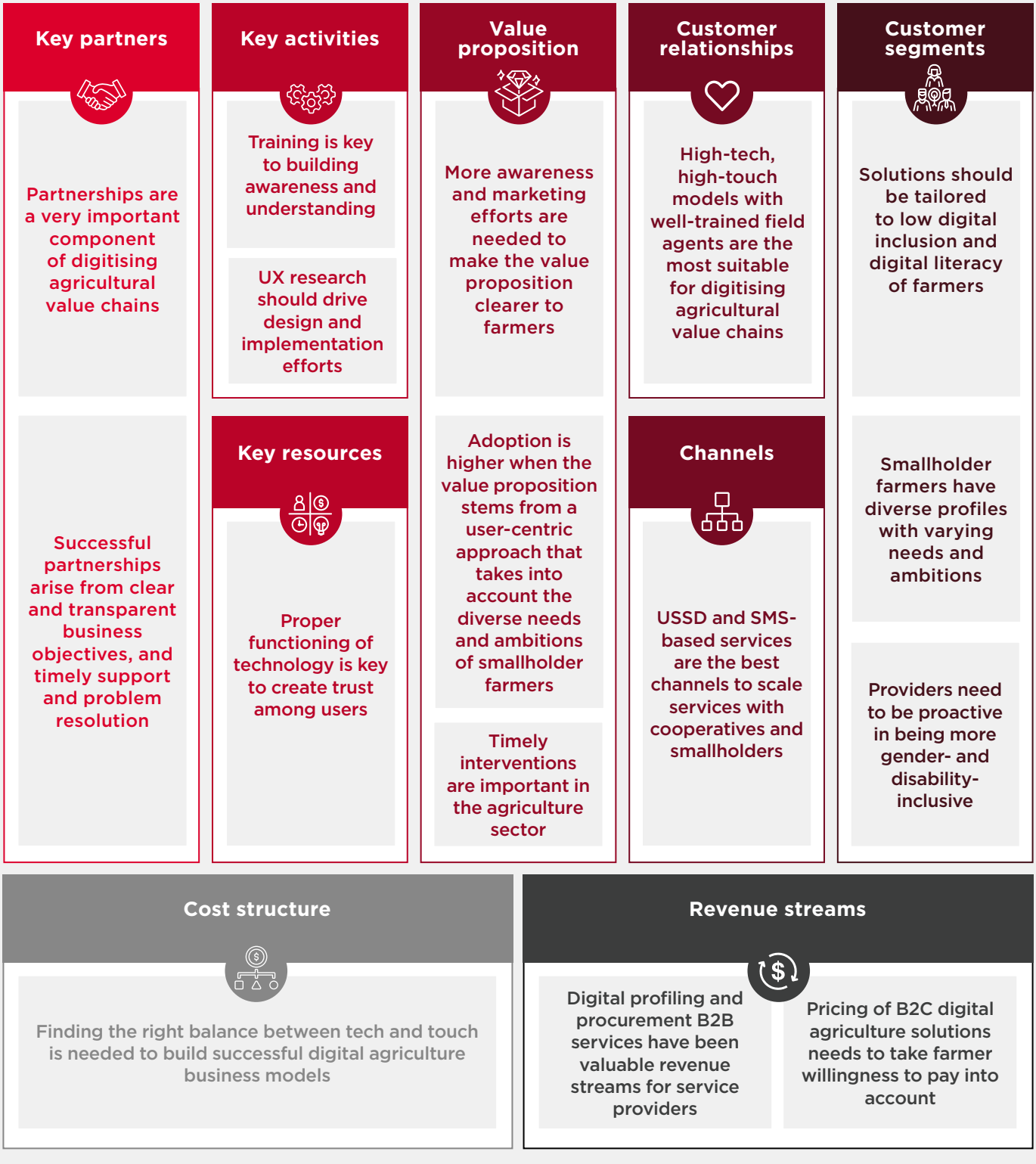
At the bottom of each page in Chapter 3 is a menu button that takes you back to this page where you can navigate to each section of Chapter 3.

This chapter presents lessons and key recommendations from the GSMA Innovation Fund based on the results presented in Chapter 2. Lessons are divided into best practices in business models related to digital agriculture services (3.1) and best practices in designing inclusive services for smallholder farmers that will increase incomes and climate resilience (3.2).

3.1 Best practices in business models

This section outlines lessons and recommendations based on what GSMA Innovation Fund grantees learned about the services they implemented, including what worked with their business model and what did not. These lessons are presented in Figure 54.

Figure 54
High-level lessons on business models implemented with the support of the GSMA Innovation Fund



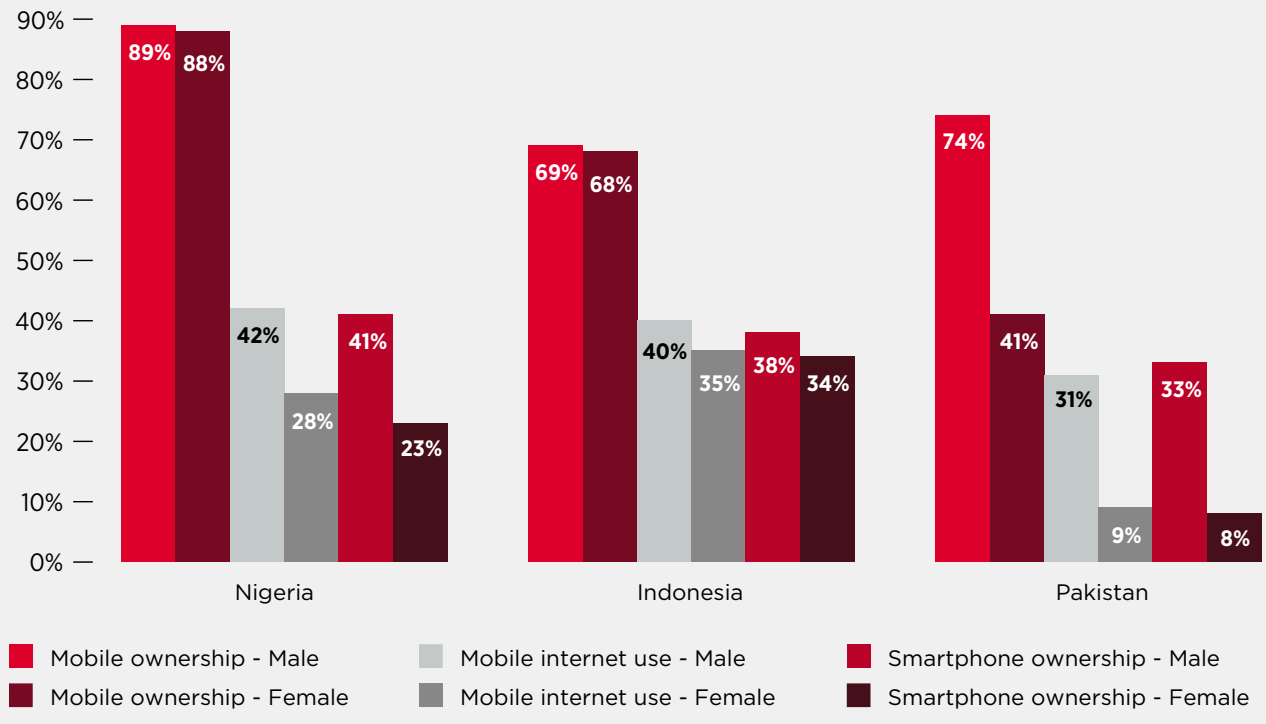
3.1.1 Customer segments

What grantees learned about the smallholder farmers they serve and their ability and likelihood to use digital solutions

The digital inclusion and digital literacy of farmers remains low across markets. There were persistent barriers to digital inclusion in most markets during the grant period. UX research, farmer interviews and project implementation all revealed that farmers are still not familiar with advanced digital technology.

While mobile phone ownership is relatively high at the household level, farmers do not always own a phone of their own, especially women. Smartphone ownership, which is required to access some digital agriculture solutions, is still rare among smallholder farmers. GSMA 2021 consumer research reveals that adults in rural areas of LMICs are 33% less likely to use mobile internet than those living in urban areas. In Nigeria, Indonesia and Pakistan, mobile phone ownership among male agricultural workers is relatively high at 89%, 69% and 74% respectively, but smartphone ownership is significantly lower, at 41%, 38% and 33%, respectively. Female agricultural workers reported even lower ownership rates in each of these markets. The gender gap is particularly wide in Pakistan where female agricultural workers are 76% less likely to own a smartphone than male agricultural workers.

Figure 55
Digital inclusion of agricultural workers in Nigeria, Indonesia and Pakistan



Source: GSMA 2021 Consumer Survey data on agricultural workers[70]

70. "Agricultural workers" are defined as those for whom agriculture or fishing is their main source of income, or main occupation/activity but not main source of income.

Bundled digital services should align on the types of phones required to access them. Unless smartphone ownership and digital literacy become more widespread, app-based services cannot target the same customer segment as digital procurement services, who largely use simple feature phones. If most smallholder farmers who register for digital procurement own basic or feature phones, then app-based advisory, payment and loan services are not going to be adopted, at least without relying on agents or cooperatives as intermediaries. Low digital literacy and data costs also result in fewer app updates, with farmers often missing out on new features or design improvements. Providers need to assess levels of smartphone ownership in their customer base and tailor their offering. Besides, not all (smart)phone owners are tech savvy – many of the farmers interviewed only use their smartphone to send text messages and make calls. Services need to be designed with simple user journeys and simple interfaces. Similarly, advisory content should adapt to local literacy levels and use common, local agronomic terminology to ensure that advice is understood and implemented.

Low connectivity in remote locations, which is where most farmers live, should be taken into account for app-based advisory services and the apps that purchasing clerks use to record procurement transactions. Connectivity issues have been a major pain point for advisory app users. They have created technical challenges for real-time digital procurement records and fostered distrust among purchasing clerks. Building in an offline version and app synchronisation is strongly recommended.

Behaviour change is most likely to happen when digital agriculture services have a clear value proposition and address users' farming-related challenges. Smallholder farmers primarily rely on traditional farming practices and cash-based transactions. Digital technologies and new farming practices need to provide clear comparative advantages to lead to adoption. Since sustainable behaviour change also relies on social influence, farmers need to see successful adoption by early adopters in their communities. Digital payments require the most behaviour change, as there is still a strong preference for cash in all markets but Rwanda, both among farmers and ecosystem stakeholders like retailers and input distributors. Rwanda is a strong example of how government-led advocacy for digital payments and the integration of digital payment options for services such as health, education and utilities have helped to normalise cashless payments.[71]

For smallholder farmers, activity rates depend on the crop and the season. Farmers' input needs and planting and harvesting calendars vary by crop and region. For example, in Nigeria where rice is cultivated from April to November, and even a month later in southern provinces, most sales happen annually near the end of the year. Tea bushes, by contrast, can be picked every week, which increases the number of sales that can be recorded digitally. Seasonality should be considered when identifying priority value chains as it can affect the value of digital procurement solutions for crop buyers.

71. For more information, see: Rwandan Ministry of ICT. (2022). Rwanda Fintech Strategy 2022–2027 Roadmap to strategy implementation and The Government of Rwanda launches a national awareness campaign on digital payments.

Digital agriculture solution providers need to be proactive in creating more inclusive services. Women represent less than 30% of digital solutions users across the GSMA Innovation Fund portfolio, as they were already less represented than men in all cash crop farming before digitisation, except tea in Rwanda and Sri Lanka. In markets where grantees operate, most women farmers do not own the land they farm and strong social norms shape their roles in the household and farm, limiting their participation in procurement activities in formal agricultural value chains.

Even when women farmers are digitally profiled, they are overall less likely to use digital agriculture services, primarily because of low digital literacy and cultural barriers. Providers should deliberately target female farmers in UX research to identify their needs, preferences, trusted circle of influence and the specific barriers they face. This will help tailor the value proposition and make digital agriculture directly relevant to women.[72] Involving male community leaders and gatekeepers in outreach activities and trainings can increase support for the adoption and use of services by women farmers. This promotes understanding of the benefits they could derive from facilitating the integration of women farmers and leads to greater buy-in.

Efforts are also needed to record gender-disaggregated data consistently across solutions. Only 18% of digital farmer profiles did not record gender information, compared to 38% on average across the other digital services (procurement, payments, advisory, loans and insurance). Digital payments made through mobile money had a particularly high amount of missing gender data (89%). Linking gender data collected in digital profiling with additional service offerings is a key opportunity to glean more insights from women's use of digital services. Finally, inclusive services need to be advertised to reach women through targeted marketing campaigns, and training sessions need to accommodate the schedules and domestic responsibilities for women to learn how to use services effectively.[73]

72. GSMA. (2022). Reaching and Empowering Women with Digital Solutions in the Agricultural Last Mile.
73. Ibid.

3.1.2 Customer relationships

What grantees learned about the relationships they need to build with smallholder farmers to ensure they adopt and use digital solutions

In-person interaction is still in high demand in farming communities, making models that rely on a mix of agent-led and digital interactions the most suitable for digitising agricultural value chains. Having a network of agents in the field has been key to onboarding farmers with digital solutions. According to AgroMall, a network of field agents has been instrumental in explaining the value proposition of digital services and registering farmers. Similarly, Jazz implemented a mentorship strategy whereby field officers act as mentors to farmers, showing them how to use the app and explaining its benefits.

> "Our strategy is to rely on ground force that have close [knit] relationships with farmers and can provide mentorship. During the profiling phase, we now keenly focus on filling the digital knowledge gap. We conduct social mobilisations, and mentor farmers on an individual basis. Our agents hand hold farmers a lot and that is key for behaviour change."
>
> **Zeeshan Mateen, Manager, Digital Content Platforms, Jazz**

Vodacom has also developed a champion model whereby individuals are hired to promote the services in their village and register farmers.

For some services, such as advisory, the combination of a human touch and digital is even more important. Most grantees have used extension agents to complement digital advisory. This in-person support has proven more impactful in delivering advice to farmers. Monitoring surveys reveal that, when asked which advice was useful to increase income, many farmers mention the human aspect of hybrid digital advisory models. In Pakistan, all farmers interviewed expressed a preference for calls or in-person meetings, as field agents were found be more responsive and knowledgeable about their land and can meet with them frequently.

> "We get advice from the local representative via the app. We take a picture and send it to them via WhatsApp and then discuss over the phone. (...) Their advice about planting potatoes a few days early really helped us to get good crop in the end."
>
> **Pakistani farmer, male, 31**

3.1.3 Channels

What grantees learned about the communication and distribution channels used to deliver digital agriculture solutions to smallholder farmers

USSD and SMS-based services can be accessed from even the most basic mobile phone, making them the best channel for scaling services with cooperatives and smallholder farmers. Vodacom's journey was particularly insightful. M-Kulima's enterprise procurement service was initially a web-based software that required AMCOS to have computers and agents equipped with smartphone apps to digitally profile farmers. Even in the absence of technical issues, low connectivity, low digital skills and slow, agent-led farmer profiling made adoption challenging. With support from the GSMA Innovation Fund, Vodacom developed a one-stop USSD service for both their B2B procurement service and B2C farmer-facing services, including the ability for farmers to self-register through basic and feature phones. This allowed them to cater to more user segments.

> "With USSD, we can reach close to the entirety of the population. That is why we consider it is a better channel than the application."
>
> **Edgar Mkobi, Project Manager, Vodacom**

Digital channels that use little to no text, such as SMS and IVR, are better suited to smallholder farmers, especially women. Farmer satisfaction surveys show that SMS agronomic advisory are more user-friendly and have higher reading rates than advisory delivered via a mobile app. Keeping SMS content simple, short and in regional or local languages where possible, and using simple, non-scientific agronomic terms is key for farmers to understand the advice. SMS, OBD and IVR channels are especially helpful for women farmers as they can read or listen to advisory messages on their own time or, if using a shared phone, when they have phone access. Both channels are adapted to users with basic phones. IVR is especially suited for women with low literacy levels and SMS for those with low digital skills.

> "As women, we have to manage all the household work. It is difficult to go out for any training."
>
> **Sri Lankan tea farmer, female, 63 years old**

> "I use my son's phone. He goes to work in the mornings, but when he is at home, he shares the phone with me if I need it for anything."
>
> **Sri Lankan tea farmer, female, 63 years old**

When using apps to deliver agricultural services in low literacy contexts, simple interfaces with clear action buttons and navigation panes are important to ensure farmers can use them. This is especially relevant for user segments with lower digital literacy levels, such as older farmers and women. To address low digital literacy among smartphone users, Koltiva simplified the app interface as much as possible. Sugata, one of Koltiva's clients, shared:

> "It was important to make the app as easy and simple as possible so farmers could use it – a lot of farmers do not understand the technology and it is difficult to explain the services to them."
>
> **Mirza, Director Operational, Sugata**

Monitoring surveys with Indonesian farmers also indicated that weather forecasts built into Koltiva's advisory app seemed to get lost in the rest of the advice. A dedicated service or weather forecast that is more visible on the app could help to raise awareness of the service, and Koltiva is considering this for future iterations. Videos can also be used as a channel for more digitally literate smartphone owners. Koltiva is developing tutorial videos to test whether video is a better channel to communicate farming advice compared to text.

Mobile money agent networks need to be strengthened so that farmers can cash out digital payments. Agent networks continue to be scarce in rural areas, which has contributed to low adoption of digital payments. Geomapping of agent distribution could help MMPs identify strategic priority areas where agent density and recruitment is needed most. They could also explore the opportunity to train farmer groups to be agents. Agent networks also need to improve their liquidity and cash flow. Across markets, mobile money agents were often found to be unable to cover the cash-out of agricultural sales. Agribusinesses and service providers could help agents know when higher liquidity is needed by informing them about harvest and farmer payment cycles in advance.

3.1.4 Value proposition

What grantees learned about the value of digital agriculture services for smallholder farmers and the extent to which they meet their needs and solve their pain points

More awareness-raising and marketing efforts are needed to clearly communicate the value proposition of digital agriculture services to farmers. Many farmers who are digitally profiled are not using the services available to them, often because they are not aware of them. For app-based weather advisory services and insurance in particular, low awareness was identified as the main barrier to usage. In Indonesia, 60% of surveyed FarmCloud users were not aware that weather forecasts were available on the service and 76% did not know how to access them. Interviews with Sri Lankan and Tanzanian farmers who use digital procurement and advisory services revealed that none knew insurance services were available.

Filling these knowledge gaps is an important opportunity. Once early adopters in Pakistan and Tanzania began using their insurance plan, 10 out of 14 farmers shared that they were satisfied with the insurance, including premiums and pay-outs. Finding effective strategies to communicate the value proposition to digitally profiled farmers should be a high priority for grantees. Having an accurate and clear database of farmer profiles is key to improving outreach, raising awareness and promoting the types of services available to farmers.

Blending in with farming communities has been an effective strategy in some markets to communicate the value proposition and gain farmers' trust. In Nigeria, AgroMall invested a lot of effort in "speaking the same language as farmers" and "blending in with the community". Developing regular lines of communication with cooperative leaders was particularly helpful in fostering trust and eagerness to get farmers on board. In Sri Lanka, Dialog relied on community leaders who were trusted by farmer groups to spur behaviour change. These community leaders are not necessarily tech savvy, but because their community relies on them for information, these leaders can be trained and help farmers become early adopters. Srinath Wijayakumara, Manager of Digital Inclusion at Dialog, recalls the story of a 70-year-old community leader who decided to buy a smartphone just so he could use the service and show the benefits to other farmers in his community. Jazz also relied on peers, local community leaders and neighbours to increase digital literacy and start changing farmers' perceptions of, and behaviours towards, digital tools.

Adoption is higher when the value proposition stems from a user-centric approach. Developing empathy and understanding of farmer segments and users through UX research and regular analysis of BI data is key to designing a value proposition that speaks to, and addresses, farmers' everyday challenges. AgroMall has been a leader in fostering a farmer-centric approach, using UX findings to redesign their processes and develop strong customer touchpoints that provide timely support. AgroMall believes that a farmer-centric approach promotes farmer loyalty and better business performance.

> "Building farmer relationships is key; it makes selling services to them easier and it makes loan repayments better."
>
> **Fejiro Gbagi, Program Manager, AgroMall**

The value proposition of digital payments depends on offering low transaction fees and building a digital payment ecosystem within reach of farming communities. Because smallholder farmers and rural ecosystem actors are extremely price sensitive, transaction fees continue to be a significant barrier to the uptake of digital payments. The cessation of digital payments in Tanzania following the government levy, and the removal of fees for digital payments (bank transfers, mobile money transfers and merchant payments) in Rwanda during the COVID-19 pandemic, are both good examples of the impact of fees on digital payment adoption. In Indonesia, transaction fees and the lack of local opportunities to use digital payments with retailers and input dealers have been a major reason why adoption of KoltiPay was so low. To boost adoption, Koltiva decided to switch digital payment providers to secure better rates.

Transaction limits occasionally make it difficult to use mobile money for agricultural payments. Similar issues were found in other markets, like Tanzania.

> "The maximum limit for mobile money transactions in Tanzania is TZS 10 million (USD 4,288),[74] so it was difficult to use the service for big farmers that have a large production to sell."
>
> **William Malecela, Field Manager, Alliance Ginneries**

74. Foreign exchange rate on 8 November 2022: USD/TZS=2,332.

In Pakistan, farmers with basic Jazz Cash accounts could not be paid fully in mobile money because transaction amounts were too high.

Withdrawing digital payments has also proven problematic due to low liquidity at cash-out points. Too often, agents do not have enough cash to issue payments. Better liquidity management is needed to spur adoption of digital payments in agricultural value chains.[75]

Farmers do not fully understand the value proposition of digital payments. Digital payments can help farmers qualify for loans but, according to Vodacom, most farmers do not understand the connection. They have started raising awareness of the importance of digital payments in building a financial track record that could support loan applications.

Addressing payment delays, which farmers consider a major pain point, is essential. Building a payment infrastructure that delivers digital payments in less than two days is essential to support the value proposition of digital payments, especially compared to bank transfers. In Rwanda, mobile money payments allow farmers to be paid much faster than the MFI-led cash disbursement model, and this has contributed to high adoption in this market.

Access to capital is a high value proposition for farmers. Input loans and the Songesha overdraft service have allowed some farmers to access loans for the first time. However, loan sizes and types need to be expanded to meet their full range of financing needs. Only input loans and overdrafts were launched during the GSMA Innovation Fund due to challenges in forming partnerships with financial institutions (see the loan section for more details). Larger input loans and expanding to cash loans would help meet farmers' financing needs and could have a greater impact on farmer incomes.

> "If only I could get someone to support me with tractors and other mechanised farming tools. My hope is to go into agricultural mechanisation in order to increase my income significantly."
>
> **Nigerian farmer, male, 40 years old**

> "If I could get more funds and inputs, I am confident my income will increase in the coming years from increasing my yield and productivity."
>
> **Nigerian farmer, female, 20 years old**

Timely interventions in the agriculture sector are important. Because farmers' activities are seasonal, timely procurement, input delivery and advisory messages are vital. Digital agriculture services may also rely on non-digital logistics, such as input supply and delivery, to meet requests for in-kind input loans and ensure farmers have their inputs in time for planting season.

AgroMall considers timely procurement of advice *"even more important than the quality of the messages themselves"*. For SMS advisory, this means that content needs to be aligned with the farming cycle to be relevant and sent frequently enough to retain high reading rates and ensure advice is received when it is needed. Timely weather advisory means providing weekly rather than daily forecasts, as weather can vary significantly in some regions and make advice unreliable. Related farming advice on how to prepare for weather events in advance, such as planting trees to provide shade or using more efficient irrigation strategies during a drought, can be valuable to farmers. Insurance products also need to be rolled out well ahead of the planting season (e.g., crop insurance) to be adopted by smallholder farmers.

75. OPML. (2020). How to Improve Liquidity Management for Agents Serving Small Informal Groups and Savers.

3.1.5 Key activities

What grantees learned were the most important activities to make their business model work

Training

Low digital literacy among farmers and collectors makes training a vital component of the digitisation of agricultural value chains. Comprehensive training was provided across the projects supported by the GSMA Innovation Fund to ensure buy-in and successful implementation of technology. Grantees in every market believe training has helped them improve awareness and understanding of their solutions, address concerns about the benefits and use of the solutions and promote behaviour change.

Training should not only target end users (smallholder farmers), but also the staff of cooperatives and agribusinesses. Staff training helped to address initial reluctance about shifting to digital procurement. In Indonesia, for example, Koltiva put considerable effort into training fermentation centre and buying station agents. Dialog and Vodacom also spent time training collectors and AMCOS to operate digital scales and record sales digitally on mobile phones. For example, Dialog has created training-of-trainers (ToT) programmes and created videos to teach collectors how to use the service.

Although farmer training is important for raising awareness and explaining the benefits of digital agriculture solutions, implementation has been challenging in some cases. Dialog's agritech partner Agrithmics reports that farmer participation in awareness-raising events and training was very low. Farmers either said they were busy or would send someone else. Dialog pivoted their approach to "door-to-door" training whereby agents would onboard and train farmers simultaneously. However, Dialog pointed out that even with this approach, the information is not properly digested.

> "One training is not enough for farmers. They easily forgot information and they need to do follow-up trainings, which costs a lot of money and is time-consuming."
>
> **Srinath Wijayakumara, Manager of Digital Inclusion, Dialog**

In Indonesia, Sri Lanka and Rwanda, COVID-19 travel restrictions, restrictions on group sizes and social distancing made delivering face-to-face training much more complex.

Product iteration workshops leveraging UX research, survey findings and BI data

UX research and design, combined with BI, allowed grantees to fine-tune their value proposition and build solutions that meet the context-specific needs and digital capacity of smallholder farmers. Grantees reported that insights from market analysis, industry intelligence and customer research were instrumental in refining their customer segmentation, marketing approach and solution design.

Customer segmentation

Grantee partners in Pakistan believe UX is *"an indispensable prerequisite for the tech-enabled solution"*. UX research helped Reap Agro realise that while digital literacy was very low among farmers, smartphone penetration was high. As their app-based model requires smartphone ownership, Reap Agro worked harder to engage farmers and incorporate their feedback in solution design. Customer personas have also helped Reap Agro and Jazz segment farmers into various niches with different needs and behaviours. In Tanzania, UX research revealed that the payment process managed by AMCOS was too slow when farmers needed real-time payments, which became a priority for Vodacom.

> "UX research is important, because we need to ensure the service complies with the interest of the farmers. We need to give farmers what they want."
>
> **William Malecela, Field manager, Alliance Ginneries**

Marketing approach

UX research helped Dialog better understand the agriculture industry and communicate more efficiently with farmers. Dialog decided to target their marketing efforts at youth, changing their language style and using promotional material that featured young male and female farmers in real-life situations. Participating in the research also helped them empathise with intermediaries, which are indispensable in the tea value chain, and understand their "language" and expectations. Dialog also learned about the pain points of agribusinesses, which helped them optimise digital collection processes.

Solution design

All grantees have used insights from UX research to customise their solutions to farmers' pain points. Jazz partners, for example, improved digital procurement by delivering receipts to farmers, as the UX research revealed that farmers preferred to have a proof of sale. In Indonesia, research revealed that farmers were mostly unaware of the advisory service available on the app. Koltiva responded by having their marketing team redesign advisory content and added SMS notifications as a feature to inform farmers about new content. Research also revealed that farmers preferred videos to text, prompting Koltiva to consider producing videos and tutorial content adapted to user preferences.

While UX research helped inform user pain points, **co-designing solutions with agribusiness partners helped ensure they were tailored to their activities and considered the needs of farmers and collectors.** This is especially important for digital procurement services as there is no one-size-fits-all solution. Some agribusinesses work with fermented and/or wet beans (e.g., Sugata in Indonesia) while others work with different types of farmers (organic and converting farmers in the case of Alliance Ginneries in Tanzania), which creates different software needs. In Sri Lanka, agribusiness partners worked with Dialog to define the type of information that should be collected from farmers, how this data should flow and the kind of VAS that were needed (e.g., training and traceability). In Tanzania, Alliance Ginneries helped create content for the farmer advisory service, providing Q&As on cotton production and simplifying content by moving away from scientific names of crop and diseases that were not easily understood by farmers.

3.1.6 Key resources

What grantees learned about the resources (material, human or financial) needed to ensure their services meet smallholder farmers' expectations

Trial runs of software and hardware technology are important for providers to ensure their technology works properly before going to market. Technical glitches have undermined farmers' and field agents' trust of digital services, which is difficult to regain. For example, Rwanda Mountain Tea reported technical issues with printers and digital scales in early trials that resulted in collectors returning to their old procurement system.

> "Devices really must be reliable because the moment that the farmers or agents perceive they cannot rely on these devices, they will give them up, keep them on the shelves and go back to the old ways."
>
> **Kizito Mugabo, M&E Specialist, Rwanda Mountain Tea**

The ability of technology to work in real time is important for service trust and adoption. The turnaround time between data collection in the field and synchronisation to the dashboard was problematic in some markets. In Indonesia, synchronisation failures with farmer profiling were a considerable pain point for collectors and diminished their trust in the technology solution.

3.1.7 Key partners

What grantees learned about third-party organisations strengthening the value proposition for smallholder farmers

Partnerships are a vital component of the digitisation of agricultural value chains. All GSMA Innovation Fund grantees relied on partnerships to offer a full suite of services to farmers. From technology providers to FSPs and content experts, every business model (MNO-led and agritech-led) should involve a range of partners to strengthen the value proposition for farmers. Outreach partners, such as government agencies and farmers' unions and federations, are also essential to gain farmers' trust and fuel adoption. Dialog, for example, leveraged a partnership with the Tea Smallholder Federation to onboard 10,000 farmers from their database and cross-sell their product. Similarly, Vodacom entered a partnership with the Ministry of Agriculture to profile farmers for a fertiliser subsidy programme, which led to a surge in digital farmer profiles.

Slow processes and alignment with partners are the main obstacles to successful partnerships. Although government bodies and farmer organisations are vital allies to onboard farmers, their operating style can be bureaucratic, with partnerships taking up to a year to establish in some cases. Alignment with FSPs was also problematic. Reap Agro reported that, as a start-up, it was challenging to "be taken seriously" by FSPs. Partnerships were explored with multiple banks but with limited success. This was due to a low focus on agriculture, not being equipped to use digital procurement data or commercial differences. Even when backed by the largest MNO in the country, it was challenging to find a bank to underwrite loans for very low returns and for farmers with no credit history. Working with cooperatives and MFIs, which are smaller and already work with farmers, has proven easier to deliver financial services to farmers.

> "Big groups often have the upper hand and end up imposing their own terms on cost of operations and pricing of the loans."
>
> **Emad Khan, Co-founder, Reap Agro**

Problem escalation and resolution was another issue with partnerships. Many grantees reported that it takes time for partners to solve technical issues, especially when multiple stakeholders are involved in service delivery. In Rwanda, for example, MTN worked with an agritech to develop their digital procurement service, which can slow down service iteration and troubleshooting.

> "MTN often had to push the agritech to resolve technical issues. Things moved too slowly, and it created two layers of communication for us."
>
> **Kizito Mugabo, M&E specialist, Rwanda Mountain Tea**

The COVID-19 pandemic stalled partnerships. Staff turnover, which has been particularly high in some markets because of the pandemic, meant that focal points kept changing and projects often had to start from scratch. Lockdowns and social distancing also made physical meetings with partners impossible.

> "Building partnerships in this context was hard. We could not meet in person, and partners were not using digital solutions for meetings, so we ended up losing a lot of time."
>
> **Srinath Wijayakumara, Manager of Digital Inclusion, Dialog**

Successful partnerships share a clear value proposition, transparent business objectives and timely support. Partnerships are more likely to be fruitful and long-lasting when partners bring clear value to the table and establish a culture of trust through transparent communication. The best practice is to set expectations from the start to avoid alignment issues later. Timely support and regular communication were other clear success factors across markets. AgroMall's cooperative partner NOMA, for example, mentioned that:

> "AgroMall was reachable, they created trust by engaging a lot with us, and if we had an issue, we could reach out to them and they will solve it in a matter of hours."
>
> **Buhari Abdullahi, General secretary, NOMA**

The role of MNOs in providing digital agriculture solutions

MNOs operate better under the B2B model of digital procurement software provider and the B2C model of digital advisory service provider, as they can leverage their core expertise in information technology, digital customer profiles and customer relationship management (CRM) tools.

Outsourcing service delivery to agritechs and agribusiness agents that are closer to farmers, know the customer segment better and are better equipped for last-mile logistics, is key to creating efficient MNO-led business models.

In more mature mobile money markets, MNOs have an opportunity to expand their digital payments and loan product offering to farmers by working with agritechs or directly with agribusinesses that want to digitise interactions with farmers. Mobile money wallets, in particular, fall under their core area of expertise and have competitive advantages over agritech e-wallets, such as an established agent network, trusted brand and more mature use cases.

Finally, as large and established corporate entities, MNOs are well positioned to broker partnerships with governments on projects linked to the digitisation of farmer profiles and digital payments.

3.1.8 Cost structure

What grantees learned about the cost of creating a successful business model

Finding the right balance between technology and human touch is key to building successful digital agriculture business models. Even though human touchpoints are essential, they are an important cost component for providers and make direct B2C models very challenging. For example, AgroMall is trying to reduce their reliance on agents by specifically targeting younger farmers who use smartphones. They are also considering moving to clustered farming to reduce agent resources.

Balancing customisation with a core product offering is a common challenge across service providers. While customisation addresses the specific needs of the B2B client and can even allow for third-party service integrations, it also increases software development costs for the service provider. These costs are then reflected in the final price of the solution and raise questions about who is responsible for customer support when third-party services are integrated.

Investments in frontier technologies to improve the value proposition, such as AI for geotagging and software development, can also be a major cost for service providers. However, a long-term perspective needs to be applied to these investments in terms of their ability to generate future revenue and efficiencies.

De-risking capital is critical to digitise agriculture value chains in the last mile, as service providers still face cost-efficiency challenges. Young agritechs, in particular, struggle to achieve commercial viability in the first few years of operation due to volatile prices, low transaction values and localised or seasonal production that make year-round agricultural activity unpredictable and risky. The GSMA Innovation Fund showed that digital agriculture solutions take at least two years to begin scaling and for smallholder farmers to accept and use a service repeatedly. During this period, de-risking capital can help agritechs test services and engage intensively with farmers.

3.1.9 Revenue streams

What grantees learned about revenue generated from digital agriculture services

Digital profiling and B2B procurement services have been valuable revenue streams for service providers. Although there are initial costs from agent-intensive farmer profiling, once farmers are profiled, the revenue generated from procurement boosts profit margins.

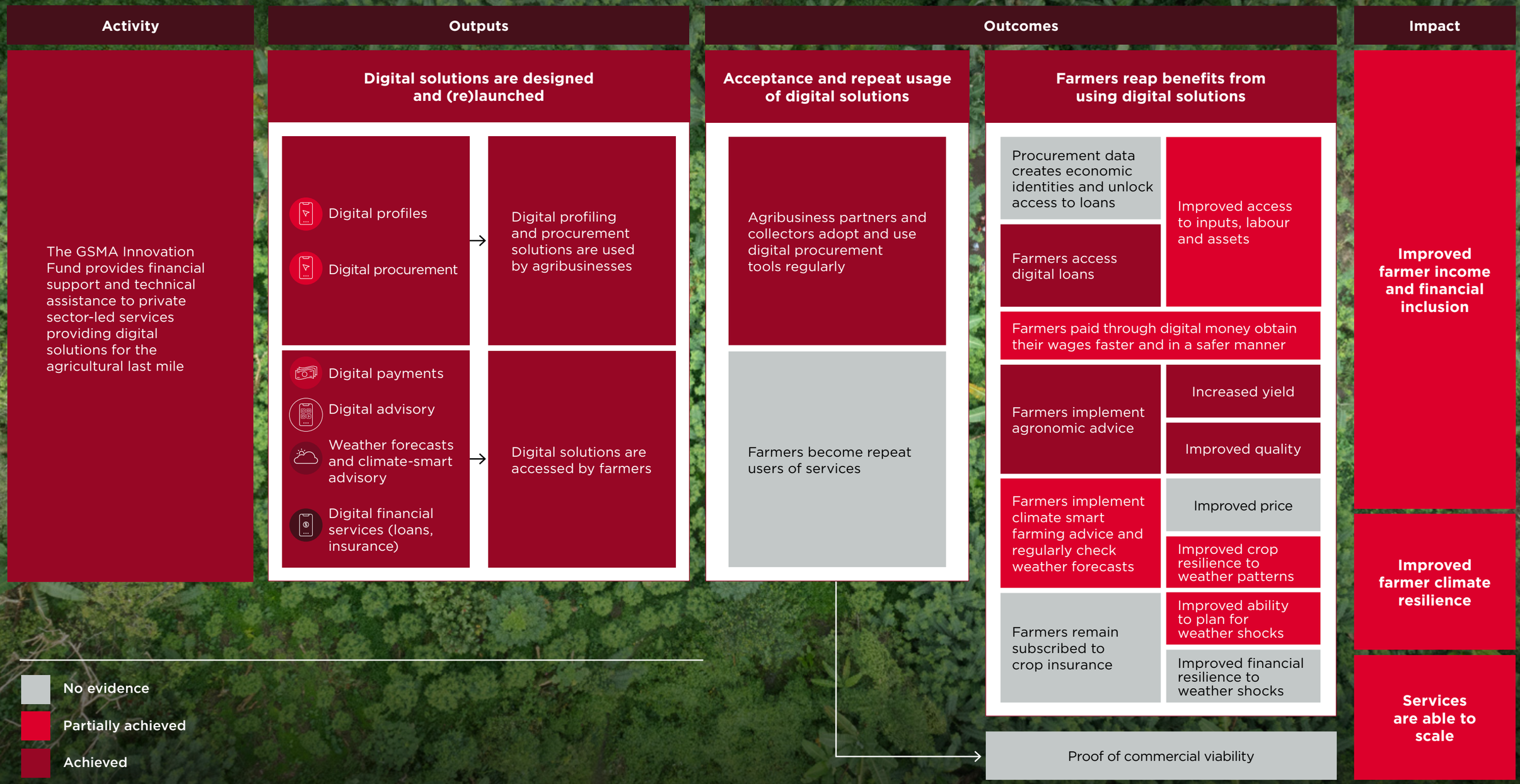
The pricing of B2C digital agriculture solutions needs to reflect the price sensitivity of smallholder farmers and low willingness to pay, even though this impacts the revenue streams of service providers. This is especially true for digital payment transactions, loans and insurance. Providers need to find innovative ways to monetise their services without necessarily charging farmer users. Freemium models, which have been used in the mainstream microinsurance sector, could be a way to get farmers to try agricultural insurance and increase their understanding and willingness to pay. Bundling services has also proven very effective for some services, such as digital advisory.

Despite grantees taking steps to smooth the user journey for digital payments, the lack of enabling environments for mobile money services and low uptake of digital agriculture payments across the GSMA Innovation Fund portfolio have **prevented digital payments from becoming a revenue opportunity.**

3.2 Impact and inclusivity

Figure 56

Pathway to impact: summary of findings



Without partnerships with banks, the input loans or small overdraft services offered by MNOs and agritechs cannot sufficiently address farmers' financing needs, such as labour and farm investments. Based on the business models employed during the grant period and the input loan services, there is no evidence that access to input loans provided by agritechs build the credit history farmers need to access loans from traditional FSPs. In the absence of partnerships between procurement data owners and banks for credit scoring, almost no farmers spontaneously used their procurement receipts to obtain a loan with a traditional bank. Securing partnerships with banks or obtaining a banking licence is therefore key to leveraging farmers' procurement data for financial inclusion.

The seasonality of crops, side-selling and service launch delays due to COVID-19 make it challenging to assess whether digitisation has had a sustainable impact on farmers. Farmers working in value chains with one harvest a year will only make one sales transaction with buyers. In addition, the pool of farmers selling their crop to an agribusiness or cooperative varies from year to year due to side-selling and farmers leaving agriculture to pursue other livelihoods. These factors limit the analysis of repeat users of digital procurement records and digital payments, which in turn limits the analysis of the sustainability of the benefits of using digital services.

Farmers perceived that digital advisory services and input loans both contributed to increased productivity and increased income. Timely input distribution and input quality are critical for input loans to raise incomes. All advisory delivery models were reported to lead to implementation of advice and higher crop yield and quality. However, SMS and IVR-based advisory are more inclusive, do not require smartphones, have more repeat users and, therefore, are better suited to smallholder farmers.

Digital payments with high transaction fees relative to income are not well suited to smallholder farmers and have a detrimental impact on income. Farmers' preference for cash remains unchanged, as the value proposition of digital payments is low in rural areas without digital payment ecosystems. High transaction fees significantly weaken the value proposition of digital payments and outweigh the benefits of better money management, safety and time savings.

Service providers need to raise awareness of relevant, low-cost climate adaptation and mitigation strategies and actively encourage farmers to implement them. Digital weather forecasts provide better access to weather information, but farmers need to receive additional advice and training to implement adaptation practices. Raising awareness of climate adaptation (versus climate mitigation) is key for farmers to understand that savings and insurance are financial mechanisms that could help them absorb climate shocks.

Digital services will have a limited impact on women farmers unless key barriers to access and usage are addressed. If the barriers that women farmers face are not addressed intentionally, digital solutions may inadvertently exclude them. It is important that solution providers consider the specific challenges, circumstances, needs and preferences of women farmers in order to design appropriate and relevant solutions. This requires not only collecting and using gender-disaggregated data, but also targeted actions to address the specific barriers women farmers face.

Table 6
Key lessons on designing inclusive, impactful services

Challenges faced by women farmers	Recommendations for providers to develop inclusive digital agriculture solutions
Less access to mobile phones (shared phones) or no phone ownership Low smartphone ownership	Clearly label all SMS/calls/payments from the digital agriculture service so that men do not become suspicious when women receive them. Encourage or prompt male farmers via digital advisory messages to share advice with their spouse. Offer SMS and IVR channels designed for basic phones for services, including procurement receipts, agronomic advisory, weather forecasts, and input loan requests.
Women farmers rarely own the land they farm, which tends to belong to their husbands. As a result, they have no land title or official entitlement to own and manage farming revenues.	Digital agriculture solutions should be offered and accessible to everyone working on the farm, not just the owner/manager.
Women farmers do not always feel safe or comfortable doing certain tasks. This includes selling their harvest to agents, requesting inputs, etc.	Increase the number of female agents. Provide women farmers with information on when and where women agents are operating.
Women farmers (who manage the farm directly) generally have smaller farms than men. Women sometimes need to hire workers to support them on the farm, especially when their husband cannot help them in the fields.	Target advice to women on small farm productivity, tailored to the activities they are engaged in. Provide tailored advice to women farmers on loans with clear, simple information on terms and conditions.
Women have little time to travel to agricultural training or pick up calls at certain times due to work and domestic responsibilities.	Provide flexible digital advisory so that agricultural training can be accessed from home on demand. Offer services that allow women to customise the times and days when messages/calls are sent to better fit their schedules. Provide training to women farmers on how to use these customisable features.

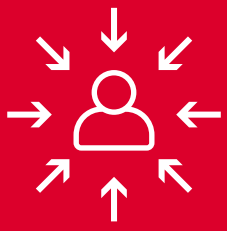
Conclusion

Conclusion

Launching digital agriculture services is a challenge, whether for agribusiness and cooperative clients or B2C services for farmers. It is a seasonal sector in which an ageing farmer base has low digital literacy skills and low rates of smartphone ownership. Two years of testing, launching and scaling digital procurement, payments, advisory, weather forecasts, loans and even insurance have generated a wealth of lessons that can inform the design of services and effective business models, partnerships and service delivery.

KEY CONCLUSIONS

Placing users at the centre of service design and delivery, whether they are agribusinesses, purchasing clerks or farmers, was instrumental in developing services with a strong value proposition.



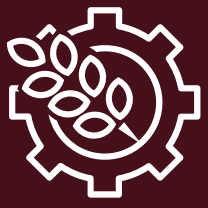
Human-centric design and iterating services leads to higher satisfaction rates among farmers and attracts more users, which are key to being impactful for farmers.

ADVISORY SERVICES, LOANS

AND WEATHER FORECASTS

are perceived by farmers as major contributors to increased income and climate resilience.

MNOs can leverage their expertise in software development, information technology & mobile money networks and rely on third-party agents for last-mile service delivery, especially for farmer profiling and registering procurement data.



Agritechs are best placed to leverage their software and technology expertise and their close relationship with farmers.

There are promising early signs that the services developed during the GSMA Innovation Fund will be commercially sustainable. All agribusiness clients shared that they find digital procurement extremely valuable and will continue using it. Digital procurement, advisory and loans seem to be the most promising as they have scaled fastest and are supported by robust business models.

Additional efforts to help farmers generate economic identities across digital service offerings will not only create opportunities to bridge the gender data gap and better understand how women farmers use digital services, but also to leverage digital economic identities for financial inclusion. Data sharing will be crucial to build stronger partnerships with FSPs and extend financing to smallholder farmers. Several grantees have already taken up this challenge.

Annexes

Annex 1: Glossary of terms

Agribusiness	Formal buyer, trader or exporter of agricultural produce, as well as input supplier. (Source: GSMA)
Agricultural last mile	In agriculture, the last mile is the web of relationships and transactions between crop buyers and farmers who produce and sell their crops. In the last mile, global markets connect with rural economies before the processes of transformation and value addition take place.
Agricultural productivity	A ratio of a volume measure of output to a volume measure of input use. (Source: OECD)
Agricultural value chains	The actors and activities that bring basic agricultural produce from the field to final consumption, with value added to the produce at each stage. Agricultural value chains can involve processing, packaging, storage, transport and distribution. Value chains can be formal or informal depending on the strength of the relationship between farmers and buyers. (Source: GSMA)
Agritech	A company providing technology-based solutions to increase efficiency, transparency and profitability in agriculture. (Source: GSMA)
B2B2C	A business model in which a company sells their product or service in partnership with another organisation to an end customer.
B2C	A business model in which a company sells their product and service directly to consumers who are the end users.
Business intelligence	Consistent use and analysis of transactional and usage data.
Bulk payment	A payment made by an organisation via a mobile money platform to an individual's mobile money account. For example, salary payments made by an organisation to an employee's mobile money account, payments made by a government to a recipient's mobile money account or payments made by development organisations to a recipient's mobile money account. With agricultural payments, an agricultural organisation uploads a bulk payment file to a mobile money or banking service, allowing a large number of funds to transfer with a single instruction. (Source: GSMA)
Climate resilience	The ability to mitigate and adapt to the impacts of climate change. This includes having the capacity to anticipate climate risks and hazards, absorb shocks and stresses and reshape and transform development pathways in the longer term. (Source: GSMA)
Climate-smart advisory	Tailored advisory content based on dynamic agroclimatic conditions at the farm location, for example, information on soil type, crops cultivated, length of cropping cycle and weather forecasts. Relevant advice is delivered at the right time on planting, input application, crop management and harvesting. (Source: GSMA)

Digital advisory	Agronomic and livestock advice to farmers on best practices, as well as market price and/or financial and digital literacy training. Digital advisory can also include advice specific to weather and climate information, including weather forecasts.
Digital literacy	Skills required to achieve digital competence, the confident and critical use of information and communication technology (ICT) for work, leisure, learning and communication. (Source: EU Commission)
Digital payments	Digital payments through mobile money and e-wallets are money transfers using a mobile phone. They enable farmers to transact with various actors within the agriculture ecosystem, for instance, making and receiving payments, including electronic vouchers to redeem agricultural inputs. Digital payments enhance the ability of farmers to save money and develop a transactional history, which can be used alongside other types of data to access additional financial services.
Digital procurement	Digital solutions in the agricultural last mile that enable a range of digital systems and processes to transition from paper to digital. These solutions help agribusinesses increase the transparency of their transactions with smallholders and improve efficiency and operational profitability. At the same time, farmers benefit from more transparent transactions, improved market access and the ability to access a digital footprint, which can be used to access financial services. (Source: GSMA)
Digital profiles	Farmer and farm data that can be used by a service provider or multiple service providers to design and direct products or services.[76] The ability to record digital profiles is included in the enterprise services offered to agribusiness and cooperative clients, which create records of their farmer base, digitise procurement transactions and payments and offer other value-added services to farmers, such as advisory and financial services. (Source: GSMA)
Financial inclusion	Access and use of useful and affordable financial products and services, including transactions, payments, savings, credit and insurance, that meet farmers' needs and are delivered in a responsible and sustainable way. (Source: GSMA)
Insurance	Digitally enabled agricultural insurance services that help smallholder farmers mitigate the risks associated with external shocks, such as weather events and pest and disease outbreaks. Agricultural insurance includes weather index, area yield index, multi-peril, livestock and livestock index insurance products.
Intermediaries	Informal brokers (also called middlemen) who trade unprocessed produce, receiving a commission for their services. (Source: GSMA)
Loans	Lending products that target smallholders and address specific agricultural needs.
Monitoring, evaluation and learning (MEL)	The routine monitoring of project resources, activities and results and analysis of information to guide project implementation.

76. USAID. (2018). Digital farmer profiles: Reimagining smallholder agriculture.

Rural account ownership (percentage)	The percentage of rural respondents who report having an account (by themselves or with someone else) at a bank or other type of financial institution, or report personally using a mobile money service in the past year. (Source: Global Findex Database 2021)
Rural residents who made or received a digital payment (percentage)	The percentage of Findex rural respondents who report using mobile money, a debit or credit card or mobile phone to make a payment from an account, or who report using the internet to pay bills or buy something online or in a store in the past year. This includes respondents who report paying bills or sending remittances directly from a financial institution account or through a mobile money account in the past year. (Source: Global Findex Database 2021)
Technology service providers	Organisations that provide their customers with technology-based solutions.
User experience (UX)	User experience (UX) puts farmers and their experience at the centre of product and service design and is grounded in continuous and structured interaction with end users. This approach helps to translate user needs into a product value proposition and ensures that all aspects of the service, from the overall experience to the details of every feature, are verified with target users. (Source: GSMA)
Users (of digital agriculture solutions)	Users are defined as farmers who have accessed a digital agriculture service at least once due to the seasonal variability of usage and type of crop grown. Digital advisory users are defined as farmers who have received an SMS advisory message, opened their advisory app or called a call centre at least once. Loan users are calculated as the percentage of farmers who took a loan out of the total farmers registered on the digital procurement solution. Procurement users are defined as farmers who had their sale recorded digitally by an agent at least once.

Annex 2: Grantee projects

This annex provides a concise profile of each GSMA Innovation Fund grantee, their partnership model, the agricultural value chain(s) in which they operate and the services they implemented with support of the Fund.

Profile

AgroMall

AgroMall is a Nigerian agritech founded in 2016. Its mission is to assist smallholder farmers and agribusinesses in digitizing their profiles, transactions, and payments. Additionally, AgroMall offers digital advisory services and access to financial services, primarily input loans. The company also offers logistics and storage solutions for agricultural produce.

Partnership model: AgroMall owns the service and primarily acts as an intermediary between their agricultural clients (agribusinesses, cooperatives and government programmes, including the Central Bank of Nigeria) and farmers (B2B2C model). AgroMall earns commissions on the bundle of services they provide to agribusinesses (farmer digital profiling, farmer advisory and commodity procurement and aggregation). Some of these services are offered through partnerships, including area yield index insurance provided by Pula Advisors. AgroMall also engages in direct procurement with rice farmers (B2C model), primarily as in-kind repayments for their input loan service.

Rice **Maize**

Nigeria

Population (2020): **208.3 million**[77]

Contribution of agriculture to GDP (2020): **24.1%**[78]

Market penetration, unique mobile subscribers (Q2 2022): **35.5%**[79]

Number of smallholder farmers (2013): **140.2 million**[80]

Rural account ownership (2021): **33.9%**[81]

Rural residents who made or received a digital payment (2021): **18.0%**[82]

77. World Bank. (2020). World Development Indicators.
78. Ibid.
79. GSMA Intelligence Portal, accessed 5 November 2022.
80. FAO. (2018). Smallholders data portrait.
81. The percentage of rural respondents who report having an account (by themselves or together with someone else) at a bank or another type of financial institution (financial institution account), or report personally using a mobile money service in the past year. Source: World Bank. (2022). Global Findex Database 2021.
82. The percentage of rural respondents who report using mobile money, a debit or credit card, or a mobile phone to make a payment from an account; or who report using the internet to pay bills or to buy something online or in a store in the past year. This includes respondents who report paying bills or sending remittances directly from a financial institution account or through a mobile money account in the past year. Source: World Bank. (2022). Global Findex Database 2021.

Services implemented by

AgroMall

Digital procurement

AgroMall developed TellAgri, a proprietary technology solution that provides more transparent transactions for agribusinesses, farmer cooperatives and government programmes. Their flagship service is farmer digital profiling, which uses both static data (farm and farmer profiles, such as farm mapping) and biometric information (i.e., farmers' fingerprints) to enhance the integrity of farmer profiles.

Once farmers are profiled, TellAgri enables AgroMall to aggregate produce from farmers or farmer organisations through their own warehouses, as well as provide logistics and input management and distribution. The price farmers receive is based on the quality and weight of the produce, which is recorded through TellAgri.

Digital payments

With support from the GSMA Innovation Fund, AgroMall added AgroWallet, a digital payment solution, to their service offering to pay farmers for their produce digitally rather than in cash. Because Nigeria has a bank-led model for DFS and AgroWallet is not integrated with other mobile money wallets, the funds still need to be transferred to a bank account to be withdrawn.

Digital advisory

AgroMall has a hybrid model of digital advisory whereby registered farmers can receive both push advisory SMS and in-person agronomist visits to their farm. TellAgri has a built-in feature that informs farmers via SMS when an agronomist is planning to visit. The cost of advisory is borne by the agribusiness or cooperative client, with no charge to farmers.

Agri DFS: input loans

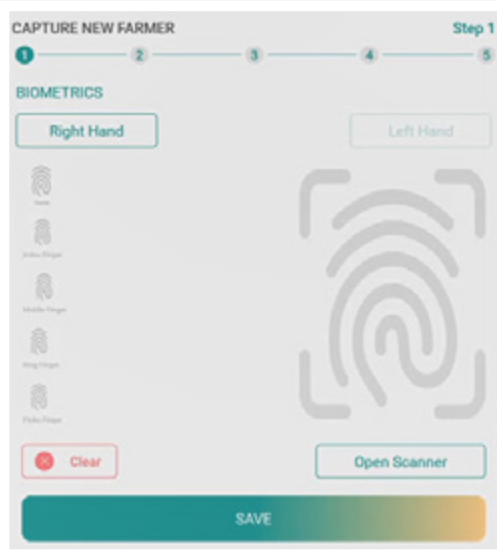
AgroMall facilitates in-kind input loans that farmers can use to borrow inputs for a one-hectare field. The loan is then deducted from their payment when they sell their crop.

With support from the GSMA Innovation Fund, loan processes were digitised. Since March 2022, AgroMall has allowed farmers to make cash payments on their input loans, although this is discouraged by applying a fee of 7% to their harvest payment.

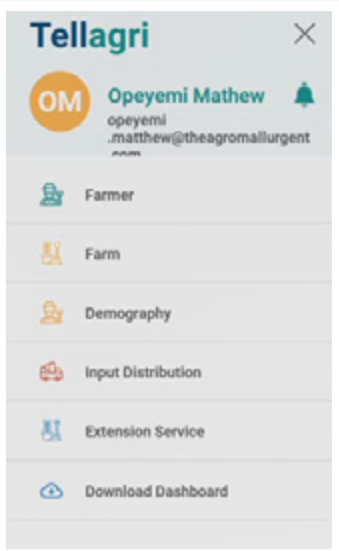
Agri DFS: insurance

Through a partnership with an insurance provider, AgroMall mitigates the risk of farmers failing to repay their input loans. Subsidised group insurance is offered to farmers with the price bundled into the loan.

Figure 57
AgroMall's farmer registration app using biometrics and the TellAgri farmer management system



AgroMall's farmer registration app using biometrics



AgroMall's farmer registration app using biometrics

Profile

Dialog

Dialog is the largest MNO in Sri Lanka with 53% of total mobile connections, delivering mobile telephony and mobile internet services to a subscriber base of 17.9 million people. Dialog has long leveraged agritech services for the benefit of smallholder farmers, developing the Govi Mithuru agricultural advisory service in 2015 and later expanding into partnerships to offer digital procurement and insurance.

Partnership model: Dialog acquired agritech Agrithmics to develop a digital procurement service used by tea factories and agribusinesses to record transactions with tea farmers. Dialog's proprietary advisory service, Govi Mithuru, is available to farmers through IVR or a smartphone app. Dialog has also partnered with Sanasa to provide weather index crop insurance.

Tea

Sri Lanka

Population (2020): **21.9 million**[83]

Contribution of agriculture to GDP (2020): **8.4%**[84]

Market penetration, unique mobile subscribers (2022): **53%**[85]

Number of smallholder farmers (2016): **1.7 million**[86]

Rural account ownership (2021): **no data**[87]

Rural residents who made or received a digital payment (2021): **no data**[88]

83. World Bank. (2020). World Development Indicators.
84. Ibid.
85. GSMA Intelligence Portal, accessed 5 November 2022.
86. Government of Sri Lanka, Ministry of Agriculture. (2016). Sri Lanka – Agriculture Sector Modernization Project.
87. World Bank. (2022). Global Findex Database 2021.
88. Ibid.

Services implemented by

Dialog

Digital procurement

The Agrithmics enterprise solution includes a mobile app for field agents to profile farmers and register tea sales, and a web portal for tea factories to monitor transaction records.

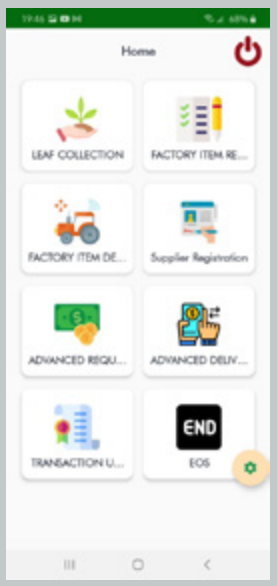
Digital advisory

Farmers self-register to the Govi Mithuru service and receive information about their registered crop as a voice message to their mobile phone (OBD). Users have unlimited free access to call 616 to listen to their messages (IVR). Govi Mithuru is also available through a mobile app.

Agri DFS: weather index crop insurance

Farmers are registered on the insurance service by Sanasa agents and pay monthly premiums to protect their crop against weather events. In the case of drought or flood, farmers receive a pay-out once local historical weather data verifies that rain levels were above or below normal amounts.

Figure 58
Snapshot of Dialog's Agrithmics procurement app and a poster for the Govi Mithuru 616 OBD/IVR service in Tamil



Dialog's Agrithmics procurement app

Poster for the Govi Mithuru 616 OBD/IVR service in Tamil

Profile

Jazz

Jazz is the leading MNO in Pakistan with more than 75 million subscribers. Jazz first entered the agriculture sector in 2017 when they began offering the mobile agricultural advisory service BaKhabar Kissan (BKK), which translates as "Informed Farmer".

Partnership model: Jazz gives farmers the option to receive digital payments via their proprietary JazzCash mobile money wallet and outsources their advisory service to agritech BKK. Jazz partners with BKK and Ricult and brought agribusiness Reap Agro onboard to digitise farmer profiling, procurement records, digital payments and advisory. Shortly after the GSMA Innovation Fund concluded, BKK acquired Reap Agro, which was rebranded as Kissan Sahara Technologies. Loans are provided in partnership with fintechs CreditPer and Finja. Insurance is offered to farmers through a partnership with Blue Marble Micro Insurance and Asia Insurance. The lending and insurance partners were brought onboard by BKK for Reap Agro farmers. Ricult began a loans pilot with HBL bank in Q4 2022.

Maize Corn | **Potatoes** | **Wheat** | **Rice** | **Sugar-cane**

Pakistan

Population (2020): **220.9 million**[89]

Contribution of agriculture to GDP (2020): **23.1%**[90]

Market penetration, unique mobile subscribers (2022): **42.84%**[91]

Number of smallholder farmers (2010): **7.4 million**[92]

Rural account ownership (2021): **16%**[93]

Rural residents who made or received a digital payment (2021): **11.53%**[94]

89. World Bank. (2020). World Development Indicators.
90. Ibid.
91. GSMA Intelligence Portal, accessed 5 November 2022.
92. Pakistan Bureau of Statistics. (2010). Agricultural Census 2010 – Pakistan Report. Smallholder farmers in Pakistan are those cultivating on farms smaller than 5 ha.
93. World Bank. (2022). Global Findex Database 2021.
94. Ibid.

Services implemented by

Jazz

Digital procurement

Ricult follows a B2B model, providing procurement software as a service to crop buyers that want to digitise their procurement transactions with farmers. Reap Agro, on the other hand, buys directly from farmers under a contract farming model using a proprietary digital procurement solution.

Although Jazz initially partnered with Ricult and BKK/Reap Agro on digital procurement, the company defined functional specifications to develop their own software with support from the GSMA Innovation Fund. This digital profile and procurement service integrates JazzCash payments and was launched in November 2022.

Digital payments

Both agritech partners can pay farmers in cash, by bank transfer or with mobile money using the JazzCash mobile money wallet or other mobile money services (e.g., Reap Agro also uses Easypaisa and FINJA wallets).

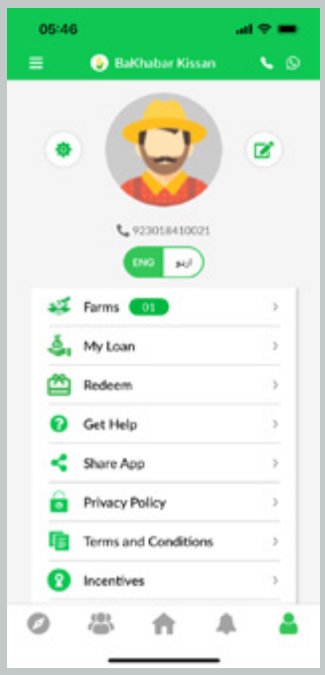
Digital advisory

Ricult offers digital advisory via SMS and an app, including a farmer forum. BKK offers advisory on crops, livestock and weather and disaster alerts via SMS, VMS, IVR, call centre, social media (YouTube, Facebook, WhatsApp, Twitter) and a mobile app. In addition to agronomic advice, farmers can also access hyperlocal weather forecasts.

Agri DFS: Input loans

Reap Agro offers crop insurance and in-kind input loans to farmers that are repaid based on a pre-determined price for agricultural produce (i.e., contract farming). The loans are interest-free in line with farmers' religious beliefs about the charging of interest. Farmers who subscribe to insurance plans are covered for the duration of the growing season.

Figure 59
BKK digital farmer profile, weather advisory and loan apps

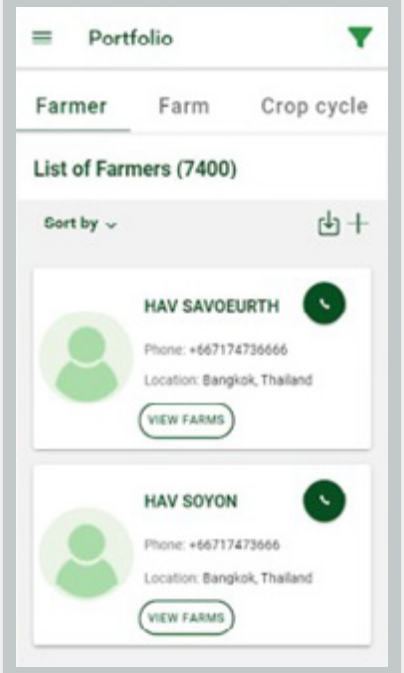


BKK digital farmer profile app

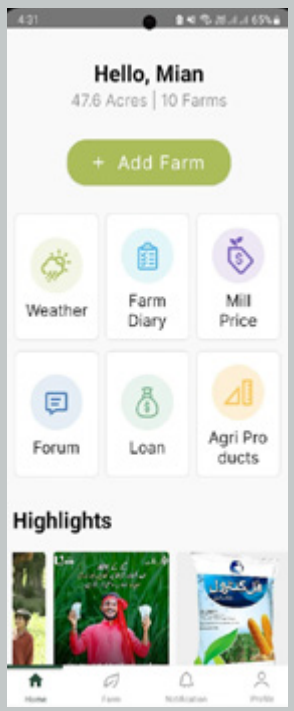
Weather advisory app

Loan app

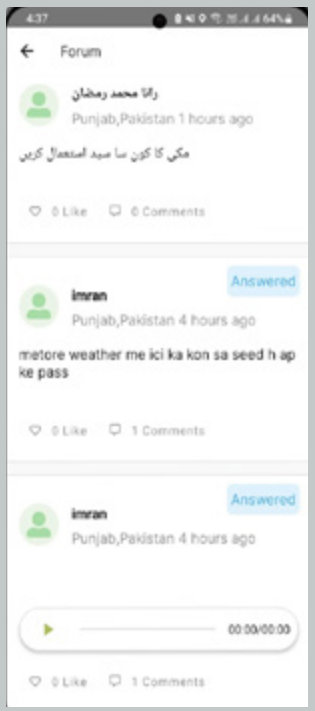
Figure 60
Ricult agent app, farmer app including advisory and loan request and farmer forum



Ricult agent app



Farmer app including advisory and loan request



Farmer forum

Profile

Koltiva

Established in 2013, Koltiva is a leading agritech for enterprises to make their global supply chains inclusive, climate smart and traceable. Koltiva combines triple tech (agritech, fintech and climatetech) to improve producers' outcomes and profitability while building more sustainable supply chains.

Koltiva provides traceability systems from seed to table through KoltiTrace, an integrated multi-crop platform for all supply chain actors. FarmCloud is a mobile app for producers, FarmGate is for collectors and traders and FarmRetail is an e-commerce platform for agri-input shops and distributors.

Partnership model: Koltiva field agents help to accelerate farmer adoption of sustainable production practices on FarmCloud apps. Koltiva digitally profiles farmers and makes on-farm visits to certified farmers, providing training and coaching and conducting surveys with FarmXtension. Using Koltiva's FarmGate app, agribusiness traders record transactions digitally and pay farmers either in cash or digitally. Procurement data is used to unlock access to loans, which are provided to farmers by a partner FSP.

Cocoa **Coffee** **Palm oil**

Indonesia

Population (2020): **273 million**[95]

Contribution of agriculture to GDP (2020): **14%**[96]

Market penetration, unique mobile subscribers (2022): **66%**[97]

Number of smallholder farmers (2003): **26.1 million**[98]

Rural account ownership (2021): **46%**[99]

Rural residents who made or received a digital payment (2021): **29%**[100]

95. World Bank. (2020). World Development Indicators.
96. Ibid.
97. GSMA Intelligence Portal, accessed 5 November 2022.
98. Central Bureau of Statistic (CBS). (2014). Sensus Pertanian 2013: Angka Tetap (Agriculture Census 2013: Final Estimate).
99. World Bank. (2022). Global Findex Database 2021.
100. Ibid.

Services implemented by

Koltiva

Digital procurement

Koltiva field agents register farmer profiles, conduct surveys and mapping and provide training and coaching on the FarmXtension app. For traceability and certification purposes, a profile can include farmer demographics, environmental data and farm information. Farmer profiles also feature production quotas, GPS location, compliance with third-party certification standards and the client's internal sustainability policy, attendance at farmer trainings and coaching reports.

Procurement is recorded on the FarmGate app, a traceability tool used by traders to record sales from registered farmers and create batches to send to the next supply chain aggregator. Collectors, traders, buying stations, warehouses and processing factories all use FarmGate to record goods received and verify the origin of their products. Notifications are then sent via the FarmCloud app or SMS to feature phones for farmers to verify the transactions. Agribusiness staff use a web portal to keep track of procurement and receive reports and infographics in near-real time.

Digital payments

Farmers receive payments from crop sales from collectors through the KoltiPay e-wallet, bank transfer and/or in cash.

Digital advisory

In addition to accessing their data profile, the FarmCloud app allows farmers with smartphones to access advisory services, including weather updates and climate-smart advisory to support better production. FarmCloud services expanded to SMS advisory in late October 2022 and e-learning material on farming practices is in the pipeline.

Agri DFS: Input loans

Farmers apply for loans with assistance from the Koltiva field agents team on the FarmXtension app or directly on the KoltiPay web dashboard. Koltiva's head office reviews the application to ensure all the requirements of the cooperative partner are met before sharing the data with the cooperative on a secure channel. The loan is disbursed in the form of agricultural inputs.

Koltiva has recently expanded the range of agri DFS accessible through FarmCloud, including loan requests, savings, bill payments, insurance and airtime top-ups.

Other

FarmRetail is a business management tool used by agricultural input providers, such as nursery owners and fertiliser dealers. The FarmRetail app can be used to manage stock, cash flow, suppliers and customers, as well as provide learning materials and advice to customers. Farmers will soon be able to use FarmCloud to purchase agricultural inputs from their nearest supplier.

Figure 61
Snapshot of Koltiva services

Profile

MTN

MTN is the leading MNO in Rwanda with 60% of all mobile connections. Having launched their mobile money service in 2009, MTN is now looking to digitise the agricultural ecosystem to increase mobile money use and financial inclusion in the country. They have deployed a digital solution that allows agribusinesses to digitise procurement and payments to farmers. Agribusinesses can use the solution to digitally profile farmers and track real-time harvest activity through online dashboards. The service is available through an app for agribusinesses and a USSD channel is being developed.

Partnership model: With support from the GSMA Innovation Fund, MTN contracted agritech Hamwae to develop digital agriculture software and create digital profiles of farmers. MTN sells the solution to agribusinesses as software-as-a-service (SaaS).

Tea

Rwanda

Population (2020): **13.0 million**[101]

Contribution of agriculture to GDP (2020): **26.3%**[102]

Market penetration, unique mobile subscribers (2022): **51.0%**[103]

Number of smallholder farmers (2010): **2.1 million**[104]

Account ownership (2021): **50.0%**[105]

Rural account ownership (2017): **no data**[106]

Rural residents who made a digital payment (2017): **31.6%**[107]

101. World Bank. (2020). World Development Indicators.
102. Ibid.
103. GSMA Intelligence Portal, accessed 5 November 2022.
104. National Institute of Statistics of Rwanda. (2021). Agricultural Household Survey 2020. The report's segmentation of farmers includes farmers cultivating on farm of less than 0.5 ha; 0.5 to 1 ha; 1 to 5 ha and equivalent to 5 ha and above. The 2.1 million figure corresponds to farmers cultivating on farms up to 1 ha; it would be 2.3 if farmers with farms up to 5 ha were considered smallholders.
105. The latest Global Findex data available for Rwanda is from 2017 and do not disaggregate urban/rural data. For this reason, we indicate data on account ownership and residents who made a digital payment although this does not necessarily reflect the situation in rural areas. Source: World Bank. (2017). Global Findex Database 2017.
106. Ibid.
107. Ibid.

Services implemented by

MTN

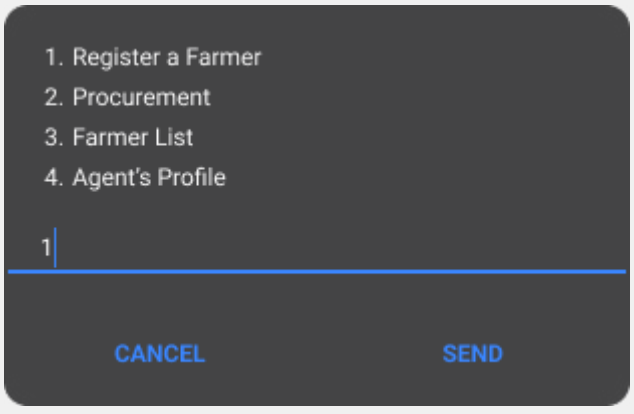
Digital procurement

Agribusinesses and farmer cooperatives can use the service to access farmers' digital profiles, which are recorded by Hamwae. Farmers are issued an RFID card that is used after harvest to record crop sales with a digital scale, issue receipts to farmers and inform the digital payment process. Agribusinesses can also track harvest collection in real time through the app.

Digital payments

MTN mobile money agents have been trained to register farmers on the MTN MoMo wallet, with additional commissions introduced as an incentive. Tea aggregators pay the tea cooperatives they source tea from via bank transfer, and cooperatives can use MoMo to pay farmers in bulk to their individual MoMo wallet instead of through the local MFI.

Figure 62
MTN's USSD-based digital profile and procurement system used by a tea purchasing clerk



Profile

Vodacom

Vodacom is the largest MNO in Tanzania with 30% customer market share as of September 2022.[108] Their mobile money service, M-Pesa, was introduced in 2008 and has more than 15.6 million customers, representing 39% market share.[109] Agriculture has long been a strategic priority for Vodacom, with ventures such as Mezzanine, a Vodacom-subsidiary technology company, and more recently M-Kulima, an enterprise solution that enables end-to-end B2B2C services that digitise procurement in the last mile.

Partnership model: Vodacom uses their own internal M-Pesa platform and leverages their internal development team to provide M-Kulima services. Vodacom has also partnered with Pula Advisors to digitise agricultural advisory services and with ACRE Africa to provide insurance services. In parallel, Vodacom has partnered with an MFI to offer Songesha, a digital overdraft service provided through M-Pesa.

Cotton Dairy Maize Lentils

Tanzania

Population (2020): **59.7 million**[110]

Contribution of agriculture to GDP (2020): **26.4%**[111]

Market penetration, unique mobile subscribers (2022): **42.3%**[112]

Number of smallholder farmers (2015): **3.7 million**[113]

Rural account ownership (2021): **48%**[114]

Rural residents who made or received a digital payment (2021): **42.5%**[115]

108. GSMA Intelligence Portal, accessed 5 November 2022.
109. TCRA. (2022). Communications Statistics Quarter 3 - 2021/2022 March 202.2
110. World Bank. (2020). World Development Indicators.
111. Ibid.
112. GSMA Intelligence Portal, accessed 5 November 2022.
113. FAO. (2015). The economic lives of smallholder farmers An analysis based on household data from nine countries.
114. World Bank. (2022). Global Findex Database 2021.
115. Ibid.

Services implemented by

Vodacom

Digital procurement

With support from the GSMA Innovation Fund, Vodacom enhanced the M-Kulima service by adding a USSD channel to their web-based solution. The USSD channel allows those without a smartphone or connectivity to access the service. The USSD user interface can also now be accessed by farmers, cooperatives and agribusinesses.

M-Kulima enables AMCOS to create farmer digital profiles and record procurement transactions digitally. Vodacom also developed a farmer-facing registration app, allowing farmers to self-register to become eligible for subsidised fertiliser.

M-Kulima also now includes an input management feature that allows farmers to request inputs.

Digital payments

M-Kulima also enables digital payments through M-Pesa. These payments are prepared by agribusinesses and paid by farmer cooperatives with their M-Pesa business accounts. Farmers receive digital receipts in Swahili.

Digital advisory

Vodacom selected Pula as their digital advisory partner to provide agronomic advice and climate-smart content to the M-Kulima farmer base. This product currently sends SMS-based soil conservation tips to farmers to help reduce soil erosion and conserve water.

Agri DFS: Overdraft service

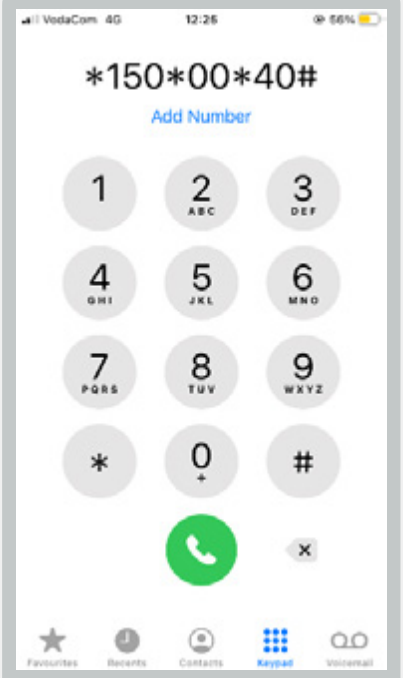
In addition to enabling digital procurement at scale, the newly developed USSD menu includes several VAS, including M-Pesa's Songesha. This overdraft product was developed in partnership with an MFI and, with support from the GSMA Innovation Fund, customised marketing and go-to-market strategies were designed to raise awareness and interest in farming communities.

Because Songesha's overdraft amounts are not always enough to meet farmers' financial needs compared to traditional loans, Vodacom and their MFI partner are exploring the possibility of developing a fixed-term loan that would use mobile money usage history and farmer procurement data from M-Kulima for credit scoring.

Agri DFS: Insurance

To strengthen farmers' resilience to climate shocks, Vodacom partnered with Acre Africa to provide a weather index-based insurance product that farmers can pay for through their M-Pesa wallet. The partners are now working to develop a more affordable insurance scheme that would insure maize farmers' seeds. The pilot for this new insurance cover began in September 2022.

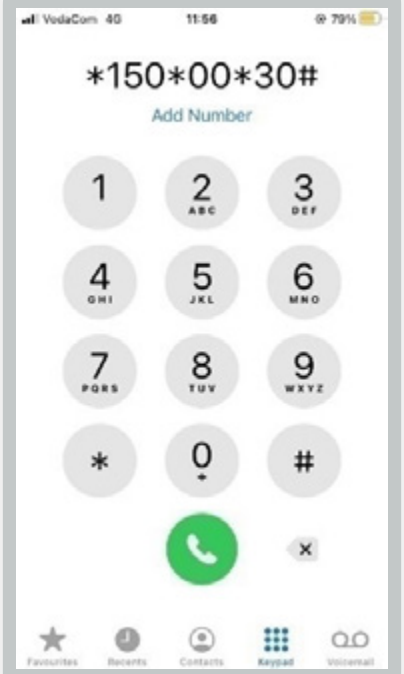
Figure 63
Screenshot of Vodacom's AMCOS M-Kulima USSD-based service



Vodacom's M-Kulima USSD-based service

Vodacom's M-Kulima USSD-based service

Figure 64
Screenshot of Vodacom's farmer-facing M-Kulima USSD-based service and farmer self-registration app



Vodacom's farmer-facing M-Kulima USSD-based service

Vodacom's farmer-facing M-Kulima USSD-based service

Farmer self-registration app

Annex 3: Processes and tools of the GSMA Innovation Fund

The GSMA AgriTech programme ran the GSMA Innovation Fund for the Digitisation of Agricultural Value Chains with the support of UK Foreign, Commonwealth & Development Office (FCDO) from June 2020 to December 2022. The GSMA Innovation Fund provided capital and technical assistance to de-risk and scale digital solutions for the agricultural last mile.[116] Grantee organisations designed, developed, tested and scaled commercially viable digital solutions that address the challenges of smallholder farmers and improve their incomes and climate resilience.

The GSMA Innovation Fund launched a call for applications in June 2019, inviting MNOs and agritechs to share a concept note detailing how they currently, or plan to, digitise transactions between formal crop buyers and smallholder farmers and provide digital solutions to address the challenges of smallholder farmers. Of 215 concept notes, 27 were invited to submit full business plan applications. The 14 strongest business plans advanced to the GSMA Innovation Fund panel for careful consideration, which selected six grantees to be contracted.

The GSMA Innovation Fund provided up to GBP 215,000 in de-risking grants with matched funding for each grantee, as well as technical assistance for the two agritechs and four MNOs to develop, test and scale bundled digital agriculture services with a consortium of partners.

Figure 65
Partners involved in developing and scaling digital agriculture solutions

116. The last mile is the web of relationships and transactions between crop buyers and farmers who produce and sell their crops. While most farmers have informal relationships with buyers, entry points for digitising the agricultural last mile are more likely to be where farmers have formal relationships with buyers, either directly or through a cooperative.

Grantees received incremental funding when they reached milestones in service development, testing, roll out and scaling.

The GSMA Innovation Fund was designed to include technical assistance tools that would enable crop buyers and smallholders to actively use digital services. The GSMA AgriTech Technical Assistance Package includes:

- Research and insights to share value chain assessments and best practices in the global agritech ecosystem and a Market Engagement Manager who consults on scaling services
- UX research
- Monitoring and evaluation surveys of farmers
- BI data analysis

The findings of the monitoring and evaluation surveys and UX research were discussed in-depth with grantees during product iteration workshops that identified service usage barriers and successes, as well as solutions to increase adoption and use.

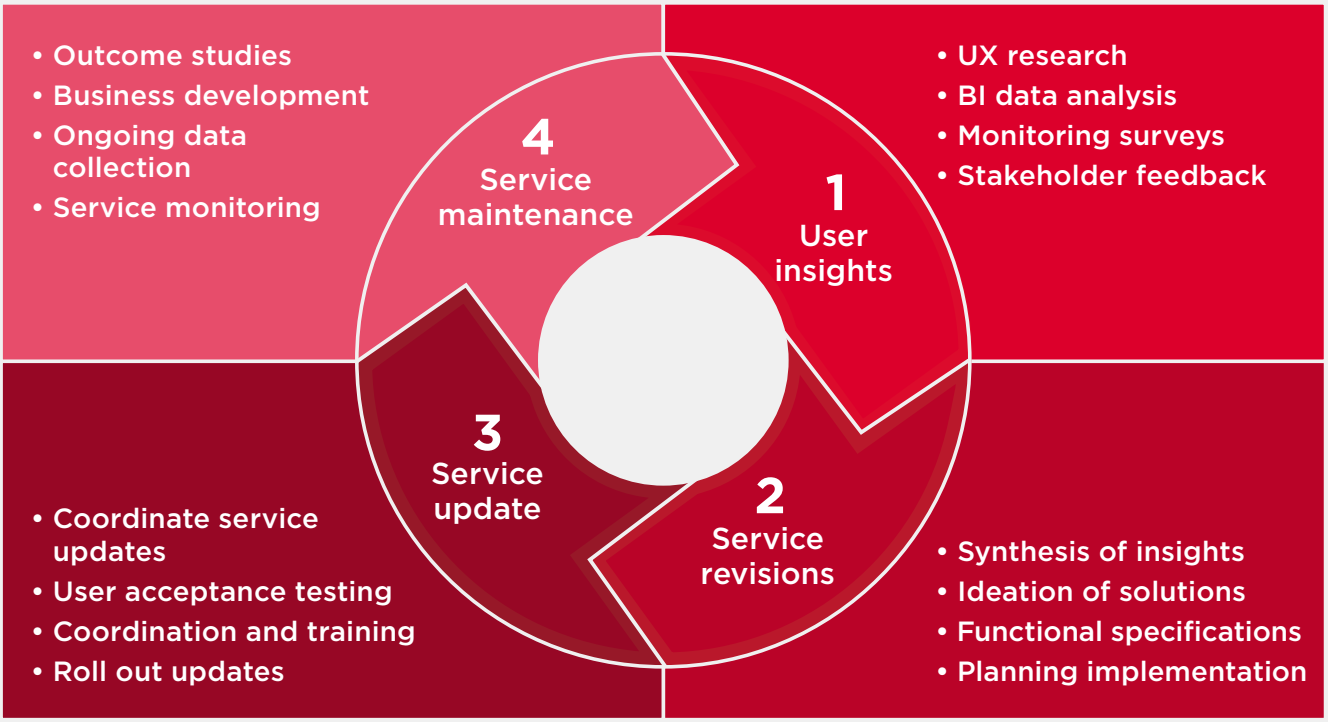
Figure 66
The GSMA Innovation Fund's technical assistance tools for product iteration

BI data analysis	Monitoring and evaluation surveys	UX	Research and insights
Analysis of service performance disaggregated by user profile	— Monitoring surveys to get feedback from farmers on services — Outcome studies to assess the impact of services on farmer income and climate resilience	— User experience research — Service design — User acceptance testing	— Value chain assessments — Business model and service analysis — Ecosystem mapping
— Synthesis of findings with grantees during product iteration workshops — Regular cross-portfolio knowledge-sharing events			

The technical assistance tools are structured around the GSMA AgriTech product iteration cycle (see Figure 67). In this cycle, qualitative and quantitative data on users are gathered to identify service revisions that address pain points or needs. The services are then updated with these changes. The performance of the service is continuously monitored to identify new user pain points. More information on the GSMA AgriTech approach to product iteration can be found in the mAgri Design Toolkit.[117]

117. GSMA. (2015). mAgri Design Toolkit. User-centered design for mobile agriculture.

Figure 67
Technical assistance provided in the GSMA AgriTech product iteration cycle



Annex 4: Survey sample sizes

	AgroMall	Dialog	Jazz/ Reap Agro	Jazz/ Ricult	Koltiva	MTN	Vodacom	TOTAL
Monitoring survey 1	406	433	201	212	404	n/a	423	**2,079**
Digital procurement	121	385	28	20	156	n/a	231	**941**
Digital payment	58	10	22	27	n/a	n/a	249	**366**
Digital advisory	239	26	170	128	248	n/a	5	**816**
Weather forecasts	n/a	n/a	184	201	n/a	n/a	n/a	**385**
Loans	145	n/a	17	n/a	n/a	n/a	n/a	**162**
Insurance	n/a	n/a	23	n/a	n/a	n/a	n/a	**23**
Monitoring survey 2	400	318	200	200	150	n/a	400	**1,668**
Digital procurement	97	117	10	21	135	n/a	191	**571**
Digital payment	69	n/a	4	21	27	n/a	221	**342**
Digital advisory	261	197	191	196	38	n/a	219	**1,102**
Weather forecasts	n/a	n/a	197	158	61	n/a	n/a	**416**
Loans	97	n/a	2	n/a	n/a	n/a	n/a	**99**
Insurance	n/a	4	3	n/a	n/a	n/a	n/a	**7**
Monitoring survey 3	400	n/a	n/a	n/a	n/a	n/a	400	**800**
Digital procurement	207	n/a	n/a	n/a	n/a	n/a	102	**309**
Digital payment	142	n/a	n/a	n/a	n/a	n/a	64	**206**
Digital advisory	275	n/a	n/a	n/a	n/a	n/a	169	**444**
Weather forecasts	n/a	n/a	n/a	n/a	n/a	n/a	102	**102**
Loans	166	n/a	n/a	n/a	n/a	n/a	71	**237**
Insurance	n/a	n/a	n/a	n/a	n/a	n/a	10	**10**
Total monitoring survey	1,206	751	401	412	554	n/a	1,223	**4,547**
Outcome study 1: survey	500	179	151	150	244	n/a	300	**1,524**
Digital procurement	110	n/a	20	7	149	n/a	212	**498**
Digital payment	57	n/a	n/a	21	59	n/a	164	**301**
Digital advisory	336	120	41	49	76	n/a	147	**769**
Weather forecasts	n/a	n/a	124	118	n/a	n/a	n/a	**242**
Loans	268	n/a	1	n/a	16	n/a	n/a	**285**
Insurance	n/a	59	3	n/a		n/a	n/a	**62**
Outcome study 1: interviews	14	11	8	n/a	12	18	8	**71**
Outcome study 2: survey	500	308	250	254	302	n/a	500	**2,114**
Digital procurement	149	n/a	67	10	228	n/a	217	**671**
Digital payment	91	n/a	3	2	93	n/a	90	**279**
Digital advisory	350	299	123	76	108	n/a	171	**1127**
Weather forecasts	n/a	n/a	232	172	166	n/a	129	**699**
Loans	387	n/a	71	n/a	19	n/a	89	**566**
Insurance	n/a	9	32	n/a	n/a	n/a	90	**131**
Outcome study 2: interviews	12	13	8	n/a	12	—	8	**53**
Total outcome study: survey	1,000	487	401	404	546	—	800	**3,638**
Total outcome study: interviews	26	24	16	—	24	18	16	**124**

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