INTERNATIONAL FOOD POLICY RESEARCH INSTITUTE
IFPRI

IFPRI PROJECT PAPER JULY 2025

Case Studies on Efforts to Digitalize Payments in Agri-Food Value Chains

Julia Wagner, Alan de Brauw, Jeffrey R. Bloem, and Kate Ambler

CONTENTS

1. INTRODUCTION

Agriculture remains the backbone of rural economies across much of both Sub-Saharan Africa and South and Southeast Asia, employing 54 and 43 percent of the workforce, respectively, and providing livelihoods for most of the rural poor (GSMA, 2020; Nair and Varghese, 2020). Yet, financial transactions in agri-food value chains continue to rely overwhelmingly on cash. The 2021 Global Findex survey finds that most adults in low- and middle-income countries who were paid for agricultural products received their payment in cash. On average, one in four recipients, and fewer than one in six in Sub-Saharan Africa, received agricultural payments into an account (Nair and Varghese, 2020; Demirgüç-Kunt et al., 2022).

This reliance on cash introduces a range of inefficiencies and risks, including high transaction costs, security vulnerabilities, lack of transparency, and exclusion from formal financial services (BTCA, 2023a). Digitalizing agricultural payments offers a promising solution to these challenges. Digital financial services (DFS) for the agriculture sector, including mobile money, e-wallets, digital banking, digital credit, savings products, insurance, and e-commerce solutions tailored to agricultural value chains, can facilitate safer, faster, and more transparent transactions while simultaneously connecting farmers and intermediary actors to broader financial ecosystems (GSMA, 2020). By digitalizing payments, farmers can build verifiable financial histories that enable access to formal credit and insurance markets, manage income more effectively, and reduce the risks associated with cash handling. For agribusinesses, digital payments offer substantial operational efficiencies: they lower cash handling costs, improve procurement transparency, support traceability initiatives crucial for compliance with international sustainability standards, and enhance supplier loyalty through faster and more reliable payment processes (Beaman et al., 2014; Nair and Varghese, 2020; BTCA, 2023a).

Despite these benefits, the adoption of digital payments for business purposes remains limited. While mobile money transactions are widely used for person-to-person (P2P) transfers, their use in business-to-business (B2B) or business-to-person (B2P) transactions is less common. This suggests that cash continues to hold significant value for businesses in many settings (Suri et al., 2023). Barriers to broader adoption include high transaction fees, technological limitations, insufficient digital infrastructure, and policy-related challenges such as business registration and taxation requirements. For example, in Tanzania, only two-thirds of attempted mobile money transactions are successful, highlighting persistent infrastructure gaps (IPA, 2022).

Nevertheless, increasing financial inclusion through DFS remains a key policy goal for many governments and organizations, particularly in rural areas of low- and middle-income countries where access to formal financial services is limited (Aron, 2018). Agri-food value chains represent a promising entry point for such efforts, given that a large proportion of the world's poor reside in rural areas and rely on agriculture for their livelihoods (Ambler et al., 2023). While many intermediary actors in agri-food value chains are familiar with digital financial products, expanding their use for business activities remains a challenge. Addressing barriers such as infrastructure, regulatory environments, product design, policy frameworks, and transaction costs will be critical to unlocking the full potential of payment digitalization in these value chains.

This report synthesizes evidence from past efforts to digitalize payments to farmers and agri-food value chain actors across selected African and Asian countries. The goal is to identify factors generating success, adoption barriers, and lessons learned to inform the analysis of readiness for future digitalization efforts.

2. OVERVIEW OF PAYMENT DIGITALIZATION IN AGRI-FOOD VALUE CHAINS

The digitalization of payments in agri-food value chains has potential to contribute to improved efficiency, transparency, and financial inclusion among smallholder farmers and agribusinesses. Global food supply chains are evolving rapidly, with a growing number of actors sourcing from smallholder farmers in remote geographies. Managing cash payments in such fragmented and geographically dispersed value chains poses substantial operational costs and risks for agribusinesses, while for farmers it increases vulnerability to theft and lack of access to broader financial services (GSMA, 2020).

The development of agricultural DFS has largely paralleled the broader expansion of mobile money ecosystems across low- and middle-income countries. Sub-Saharan Africa has led the adoption of mobile money services, driven by the success of platforms such as M-PESA in Kenya. In the region, approximately 33 percent of adults now use a mobile money account (Demirgüç-Kunt et al., 2022), and around 10 percent of GDP in transactions occurs through mobile money channels (GSMA, 2020). This widespread mobile money infrastructure has allowed agribusinesses and service providers to introduce digital procurement and payment services targeting farmers in structured value chains such as coffee, tea, cocoa, and dairy (GSMA, 2020). The strongest uptake of digital payments has occurred in formal, export-oriented value chains, where large agribusinesses have pre-existing relationships with farmers and international market pressures drive demand for traceability and transparency (GSMA, 2020). In contrast, informal value chains for staple crops like maize, rice, fruits, and vegetables face greater challenges, including fragmented production, inconsistent demand, and limited aggregation points, which complicate the deployment of digital tools (GSMA, 2020). High transaction costs and fees may also outweigh the benefits of digital payments in many value chains, especially when profit margins are small (Were, 2017).

The agricultural DFS landscape varies widely across regions. In Sub-Saharan Africa, mobile money providers, led by large mobile network operators, have played a central role in the ecosystem. In East Africa, mobile network operators like Safaricom in Kenya and EcoNet in Zimbabwe have been instrumental in enabling agri-tech solutions by integrating mobile money application programming interfaces (APIs), providing an established user base, and facilitating partnerships with banks and governments. In contrast, West African markets like Nigeria, where mobile money ecosystems are less mature and interoperability is limited, have seen slower scaling of agricultural DFS (GSMA, 2020). In South and Southeast Asia, fintech companies and tech players have taken a more prominent role in developing agricultural DFS, as mobile money penetration remains comparatively lower. Innovations in these regions have centered around data-driven credit scoring, digital procurement solutions, and e-commerce platforms that link farmers to urban markets. Indonesia's Koltiva, for example, offers digital traceability services across value chains like cocoa and rubber, helping farmers access sustainability markets (GSMA, 2020).

However, despite the expansion of services, major gaps remain in uptake and impact. Women farmers, who constitute 43 percent of the agricultural labor force globally, are systematically excluded from the benefits of digital agriculture solutions due to social norms, lack of mobile phone ownership, and the digital gender gap (GSMA, 2022). Initiatives such as TruTrade in Kenya and Uganda have demonstrated

that proactive measures, including dedicated account-opening campaigns and tailored literacy training, are needed to ensure women's inclusion in digital payment systems (GSMA, 2022).

Across regions, successful payment digitalization efforts share certain enabling conditions: widespread mobile money penetration, trusted partnerships with agribusinesses, strong field agent networks for onboarding and farmer education, supportive regulatory environments, and the ability to bundle payments with additional services such as input financing and advisory support (GSMA, 2020).

The case studies that follow are selected to illustrate in more depth how different models approach the digitalization of agricultural payments. The case studies highlight diverse contexts and mechanisms, from mobile money-integrated procurement platforms to company-led digital wallet initiatives and allow for a close examination of the key success factors and barriers encountered across different value chains and geographies.

3. CASE STUDIES

3.1. Mobile Money-Enabled Procurement in Kenya: M-PESA & Connected Farmer

Launched by Safaricom in 2007, Kenya's M-PESA is the most prominent example of mobile money's potential. Initially designed to facilitate microfinance loan repayments, it quickly evolved into a comprehensive money transfer and payment service. Its success has inspired the development of similar services across the developing world (Suri *et al.*, 2023). Despite many recent innovations in mobile money, M-PESA remains a valuable case for understanding the factors and business models that drive, or hinder, adoption.

Key factors that enabled the success of M-PESA include Safaricom's dominant market position, a widespread rural agent network, a simple and user-friendly platform, and a regulatory environment that adopted a "test-and-learn" approach (Mas and Morawczynski, 2009; Mas and Radcliffe, 2010; Vaughan, Fengler and Joseph, 2013). M-PESA also lowered entry barriers by offering free deposits, ATM withdrawals, and the ability to send money to non-users, helping to build trust and accelerate adoption (Mas and Ng'weno, 2010; Mas and Radcliffe, 2010). By 2021, M-PESA had achieved near-universal coverage, with over 80 percent of Kenyan adults registered (Parlasca, Johnen and Qaim, 2022).

While M-PESA significantly expanded access to digital financial services in Kenya, its adoption for agriculture-specific transactions remains limited. Only about 15 percent of farmers use the platform for agricultural payments (Parlasca, Johnen and Qaim, 2022). A 2024 survey by 60 Decibels found that although 56 percent of Kenyan farmers use some form of digital farming service, only 8 percent use DFS to sell produce, and awareness of digital market services remains low (Turner, Al-Saidi and Yadav, 2024).

Recognizing these gaps early on, the Connected Farmer Alliance (CFA), a partnership launched in 2012 between Vodafone, TechnoServe, and USAID, developed the Connected Farmer platform building on M-PESA's infrastructure to digitalize procurement processes between agribusinesses and farmers. This mobile- and web-based supply chain management system integrates services such as farmer registration, digital payments, SMS communication, digital weighing, and record-keeping. The platform operates on a fee-for-service model, where agribusinesses pay based on the number of actively registered farmers, reducing the cost burden on farmers (Technoserve, 2016).

In 2014, the Kenya Nut company piloted Connected Farmer to address the inefficiencies and risks of handling large-scale cash payments, at times exceeding USD 130,000 daily during peak seasons. The pilot reached over 20,000 farmers and reportedly cut operational costs by approximately USD 228,000 per year (Technoserve, 2016).

Qualitative interviews and focus groups conducted by TechnoServe in early 2016 with farmers, agents, and Kenya Nut staff highlighted numerous benefits: faster and safer payments, improved saving behavior via mobile wallets, and reduced impulse spending. Kenya Nut staff reported enhanced transaction speed, reduced theft risk, and improved record-keeping. Initial challenges include farmer distrust of digital payments, poor rural network coverage, and withdrawal fees. However, these were largely overcome through intensive training and education efforts, with nearly 80 percent of farmers preferring mobile over cash payments by the second year (Technoserve, 2016).

The M-PESA and Connected Farmer initiative demonstrates how strong infrastructure, combined with a motivated apex actor like Kenya Nut, can drive early adoption of digital tools in agricultural value chains. The initiative achieved notable operational gains, reducing cash handling, cutting transaction costs, and fostering greater trust and savings behavior among farmers. But as more recent data on transactions suggests, the long term sustainability of efforts like this one remain unclear. This case highlights the importance of aligning digital payments with clear incentives for both agribusinesses and farmers, while underscoring the critical role of rural connectivity, trust-building, and ongoing user support in translating early successes into lasting, inclusive adoption.

3.2. Cargill's Company-Led Digitalization of Cocoa Payments in Côte d'Ivoire

Company-led initiatives have been instrumental in advancing the digitalization of payments to farmers and other actors within agri-food value chains. Companies such as Cargill and Olam have implemented a range of digitalization efforts, from small-scale pilots to full digital payment systems (BTCA, 2020a).

Cargill's experience in the cocoa sector of Côte d'Ivoire offers a particularly illustrative example. Under the Partnership for Financial Inclusion, implemented by the International Finance Corporation (IFC) between 2013 and 2018, Cargill collaborated with financial institutions and mobile network operators to digitalize premium payments to certified cocoa farmers. The initiative aimed to replace traditional cash disbursements with mobile money and bank transfers, thereby enhancing efficiency, transparency, and financial inclusion in a sector where over USD 2 billion in cash was distributed annually. Market diagnostics indicated favorable conditions: mobile money penetration exceeded 50 percent among surveyed farmers, mobile phone ownership was widespread, and 73 percent of farmers expressed a preference for digital payments. Two models were piloted: (1) bank account-based payments with an option to transfer funds to mobile wallets, and (2) direct mobile money transfers, which simplified onboarding by removing the need for bank accounts (Denyes *et al.*, 2018).

Despite these promising conditions, the project faced several implementation challenges. Coordination gaps between partners, particularly in synchronizing account and wallet registration, constrained rollout. Inadequate rural network infrastructure in some pilot areas and burdensome documentation requirements for account activation further limited uptake.[1] Key lessons include the importance of clearly defined part-

[1] More than 50 percent of the population do not have formal ID in Cote d'Ivoire.

ner roles, infrastructure readiness, alignment of private and public interests, user education through targeted training, and bundling digital payments with other financial services to foster sustained engagement. The initiative highlights the potential of multi-stakeholder partnerships to digitalize agricultural payments, while underscoring the need for strong policy support and user-centered design (Denyes *et al.*, 2018).

Cargill has replicated similar efforts in Ghana and Cameroon (BTCA, 2020b). In Ghana, the company digitalized all premium payments to farmers via mobile banking, reaching 19,458 farmers during the 2022–23 period. In Cameroon, 20 percent of registered farmers enrolled in the mobile banking system, although only 4 percent received payments digitally. Across both countries, roughly 33 percent of Cargill-affiliated farmers were registered with mobile banking services by 2022–23 (Cargill, 2023).

Cargill's digital payment initiatives highlight the potential of private sector-led coordination when a strong apex actor has clear incentives to invest in digitalization. As a major buyer with a vested interest in improving traceability, reducing cash-handling risks, and strengthening supplier relationships, Cargill played a central coordinating role across its cocoa supply chains. The rollout was particularly successful in Ghana, moderately effective in Côte d'Ivoire, and more limited in Cameroon due to infrastructure and registration challenges. These experiences underscore how the presence of a motivated apex actor can drive adoption but also reveal that long-term success depends on addressing persistent barriers such as digital literacy, rural connectivity, and access to complementary financial services.

3.3. Sector-Wide Digitalization of Payments in Rwanda's Tea Sector

Rwanda's tea sector illustrates a notable example of successful multi-stakeholder coordination. As the country's third-largest employer, supporting approximately one million livelihoods, the sector has pursued digital solutions to reduce costs and enhance transparency. By 2021, seven of the eighteen tea factories had adopted digital payments via mobile money, automated Savings and Credit Cooperative Organizations (SACCOs), and online banking, reaching around 22,000 smallholder farmers. Reported benefits include a 10 percent reduction in labor costs by eliminating "ghost workers" and a 30 percent increase in productivity. A supportive policy environment, including Rwanda's Vision 2050 agenda promoting a cashless economy and a notable rise in adult digital payment usage (i.e., from 6 percent in 2016 to 25 percent in 2020), contributed to this progress (BTCA, 2023b).

The digitalization process involved multiple components. Most tea factories digitalized their operations through enterprise resource planning solutions that cover both field and factory activities, including employee payments. SACCOs serving tea farmers, a mix of dedicated tea SACCOs and Umurenge SACCOs, were integrated into payment systems to facilitate seamless payment disbursement. With support from Access to Finance Rwanda (AFR), at least four tea SACCOs were fully automated, with nine more undergoing similar upgrades. Separately, the National Bank of Rwanda (BNR) and the Rwanda Cooperative Agency initiated automation of 416 Umurenge SACCOs, though slow progress has hindered widespread adoption among smallholder farmers. In factories utilizing automated SACCOs, data sharing between factories, cooperatives, and SACCOs remained limited to essential payment details such as deductions and credited amounts. Farmers received mobile alerts upon account crediting and could transfer funds from SACCO accounts to mobile wallets. Some factories used bulk mobile money payments, providing mobile money operators with only phone numbers and payment amounts. However, challenges such as scam calls claiming erroneous transfers persisted (BTCA, 2023b).

To evaluate the effects of this transition, BTCA conducted a survey of over 500 stakeholders in the tea sector. Findings show that while digital systems improved several aspects of payment delivery, adoption remained uneven. Farmers reported substantial benefits, including faster payments (with processing time reduced by 87 percent, from four weeks to three days), time savings (30 percent), lower transport costs (23 percent), and greater transparency regarding cooperative deductions, which fostered trust and retention. Yet usability barriers were widespread: 58 percent of farmers, and 66 percent of women, needed assistance to use digital payment systems. This gender gap is particularly notable given women's large presence in the sector. Other constraints include fraud concerns, unclear transaction fees, limited agent liquidity, language barriers, and inconsistent mobile network coverage. Additionally, interoperability issues and high cross-platform transaction costs further restricted usage (BTCA, 2023b).

Rwanda's tea sector digitalization demonstrates how strong public sector coordination can effectively drive sector-wide adoption of digital payments. Supported by Rwanda's Vision 2050 cashless agenda and bolstered by SACCO automation, enterprise resource planning, and collaborative partnerships across factories, cooperatives, mobile operators, and financial institutions, the initiative reduced processing times, improved trust, and boosted productivity. Yet, gendered usability gaps, fraud concerns, language barriers, and infrastructural constraints continue to limit inclusive adoption, especially for women and remote farmers.

Looking ahead, expanding access to digital savings and credit products could further enhance economic opportunities for farmers. Improving mobile network coverage, addressing language barriers, and ensuring transparent fee structures will be essential for broader and more equitable adoption. The ongoing implementation of the Rwanda National Digital Payment System (RNDPS), which aims to enable interoperability across platforms, may also help overcome some of these constraints (BTCA, 2023b). Overall, Rwanda's experience demonstrates how a well-coordinated, public sector led approach can catalyze digitalization at scale, especially in settings where private incentives alone are insufficient to overcome systemic constraints.

3.4. AgroCenta's Digital Marketplace Model in Ghana

Another notable innovation in the digital agriculture landscape is the emergence of digital marketplaces, which connect farmers directly to buyers and integrate digital payment solutions to facilitate seamless transactions (GSMA, 2020). One such example is AgroCenta, a Ghanaian AgriTech startup founded in 2015, which developed two core services, AgroTrade and AgroPay, to support smallholder farmers in the rice, maize, millet, and soybean value chains (GSMA, 2019). Operating under a business-to-business-to-consumer (B2B2C) model, AgroCenta aggregates crops from smallholder farmers and manages the sale to industrial buyers, handling client acquisition and price negotiation in return for a 30 percent margin on the final selling price.

AgroTrade was initially launched as an online marketplace, though it did not facilitate direct transactions between farmers and buyers (Von Bismarck-Osten, 2021). Instead, local agents played a critical role by registering farmers, inspecting crops, performing quality checks such as moisture testing, and uploading trade details, including commodity type, quantity, market price, and mobile money account information, to the platform. Once verified by AgroCenta's central office, payments were made directly to farmers via mobile money, and the farmer's produce was dispatched to storage facilities for processing and distribution (GSMA, 2019).

To support secure and timely transactions, AgroCenta partnered with MTN and Vodafone to integrate mobile money APIs into AgroPay. These telecom partners also provided on-the-ground financial literacy training to help farmers manage digital payments. As of July 2019, AgroCenta had registered 46,100 smallholder farmers on the AgroTrade platform across four regions and 640 communities, with 2,750 farmers in the Upper East and Northern regions actively using AgroPay. The company reported that participating farmers experienced increased incomes, a reduction in food waste, and a rise in crop yields (GSMA, 2019).

Between 2018 and 2020, AgroCenta restructured its digital services, replacing AgroTrade and AgroPay with two new platforms, CropChain and LendIt, launched in 2020 (Von Bismarck-Osten, 2021). CropChain continues to support agricultural production processes, while LendIt was redesigned as a comprehensive multi-sided platform. It connects smallholder farmers with a range of service providers, including commercial banks, insurance companies, and pension institutions, to offer input financing, digital payments, crop insurance, and pension products. These services are delivered through physical LendIt Kiosks in underserved areas lacking formal banking infrastructure (Von Bismarck-Osten, 2021; Restropo et al., 2023).

LendIt operates by maintaining a centralized farmer database, which is shared with partner institutions to facilitate service delivery. AgroCenta enters formal agreements with service providers and, for financial institutions, supplies lists of pre-screened, creditworthy farmers, reducing their risk exposure. Revenue is generated through annual subscription fees and service commissions. The platform also employs alternative credit-scoring models using real-time data collected through CropChain, allowing for seamless integration of production and financial services (Von Bismarck-Osten, 2021).

To scale efficiently, AgroCenta partnered with farmer associations and cooperatives, rather than engaging individual farmers. Reported outcomes include significant productivity gains and improved inclusion, with women representing 40 percent of registered farmers and 60 percent of loan recipients. The platform also attracted younger users, with the majority aged 20–45. As of 2021, AgroCenta reported having 45,000 farmers registered on the CropChain platform (Von Bismarck-Osten, 2021). This figure reflects registrations following the restructuring and replacement of the earlier AgroTrade platform, during which overall farmer enrollment appears to have plateaued.

AgroCenta demonstrated early promise by bundling input financing, crop insurance, and digital payments, and by leveraging partnerships with telecom providers, financial institutions, farmer associations, and cooperatives to build trust and expand access. Its focus on inclusion was evident, with women making up 40 percent of registered farmers and 60 percent of loan recipients, and younger farmers representing a significant share of its user base. However, despite these advances, farmer registrations plateaued after 2019, and the long-term impacts of its restructured platforms, CropChain and LendIt, remain unclear. In practice, AgroCenta achieved stronger uptake of bundled services than digital payments themselves, illustrating both the promise and the limitations of private sector led digitalization efforts within agri-food value chains.

3.5. AgroMall’s Digital Procurement Planform in Nigeria

AgroMall in Nigeria illustrates how digital procurement platforms, combining mobile-money payments with real-time data capture, traceability, and biometric profiling, can replace paper-based systems to enhance transparency, efficiency, and farmer credit assessment in last-mile aggregation (GSMA, 2020).

Founded in 2016, AgroMall is a Nigerian agritech company focused on digitalizing agricultural value chains, particularly in rice, maize, and cotton. Its core services aim to assist smallholder farmers and agribusinesses by digitalizing farmer profiles, transactions, and payments (Adeniyi and Obodoekea, 2020; GSMA, 2023). AgroMall operates primarily through a B2B2C model, serving as an intermediary between agricultural clients, including agribusinesses, cooperatives, and government programs such as those run by the Central Bank of Nigeria, and farmers. It earns commissions on bundled services provided to agribusinesses, including farmer profiling, advisory services, and commodity procurement and aggregation. Some services, such as area yield index insurance, are delivered through partnerships with external providers like Pula Advisors. AgroMall also engages in direct procurement from rice farmers under a B2C model, mainly to facilitate repayment of its in-kind input loan offerings (GSMA, 2023).

The company's digital procurement system is built on its proprietary platform, TellAgri, which integrates static farm-level data with biometric identifiers, such as fingerprints, to ensure the integrity of farmer profiles. TellAgri enables AgroMall to aggregate crops from individual farmers or cooperatives, manage logistics, and facilitate input distribution. Farmers' payments are determined based on the quality and weight of their produce, both of which are assessed and recorded within the system. To complement its procurement services, AgroMall introduced AgroWallet, a digital payment solution designed to transfer payments directly to farmers. However, due to Nigeria's bank-led DFS model and limited wallet interoperability, cashing out requires transfer to a bank account, which significantly reduces convenience (GSMA, 2023).

In parallel with procurement and payment functions, AgroMall offers digital advisory services through a hybrid delivery model. Registered farmers receive both SMS-based advice and in-person visits from agronomists, with scheduling notifications sent via TellAgri. Advisory costs are borne by AgroMall's agribusiness and cooperative clients, allowing farmers to access these services free of charge. Additionally, AgroMall also provides in-kind input loans for farmers, typically covering inputs for a one-hectare field, with repayments deducted from harvest proceeds. Since March 2022, cash repayment has been allowed, though it is disincentivized through a 7 percent fee deducted from the harvest payment (GSMA, 2023).

During its participation in the GSMA Innovation Fund, AgroMall digitally profiled 86,094 rice and maize farmers. More than 75 percent enrolled in digital advisory services, making this the company's most adopted value-added service. Over 60 percent of farmers also accessed input loans. However, only 14 percent had a digital procurement transaction recorded, revealing a drop-off between registration and actual use (GSMA, 2023).

AgroMall's agent-led model was essential for farmer onboarding and trust-building. Agents engaged directly with farmers, explained the benefits of digital services, and embedded themselves in communities by working closely with cooperative leaders. This localized approach helped overcome skepticism and fostered adoption (GSMA, 2023).

Despite early successes, AgroMall faced several challenges. Most notably, digital payment usage was not sustained: 100 percent of farmers used the payment system only once during the project period. Limitations in AgroWallet's interoperability and low acceptance of digital payments among rural retailers diminished its practicality. Still, digital procurement was well received: 82 percent of male and 84 percent of female respondents preferred the digital system over manual methods. Farmers appreciated faster transaction processing and reported positive income effects, with 93 percent indicating that digital payments had improved their earnings. Farmers with e-wallets linked to bank accounts found it easier to manage and save funds, though 21 percent cited increased transaction costs. However, these results

should be interpreted cautiously, as AgroMall had provided a NGN 20,000 (approximately USD 46) sign-up bonus to incentivize wallet adoption (GSMA, 2023).

AgroMall also introduced digital credit via its in-kind loan program, which appealed to farmers due to interest rates lower than those offered by banks or informal input dealers. Gender gaps remained: only 38 percent of women with digital profiles accessed loans, compared to 54 percent of men. Barriers include the need to engage with predominantly male agents and challenges specific to in-kind repayments, which may be particularly difficult for women farmers (GSMA, 2023).

Internally, AgroMall invested in building its own digital infrastructure, employing in-house developers to improve responsiveness and integrate additional features such as quality-based payment grading. The company prioritized user-centered design, adapting its services based on user experience (UX) research to better align with farmer needs (GSMA, 2023).

According to company reports, AgroMall's services led to significant income and productivity gains. Farmers saw income increases of 75–100 percent over two to three years, tied to yield improvements of 50–75 percent per acre. The company's growth also contributed to over 5,000 new jobs across the broader value chain, including roles in transport, warehousing, and processing (Von Bismarck-Osten, 2021).

AgroMall achieved high farmer registration and strong uptake of advisory and input loan services, yet digital payments were used only once by most farmers, highlighting a significant gap between initial engagement and sustained adoption. This case demonstrates that while bundled services can deepen trust and drive value, a core payments solution must be equally robust, accessible, and aligned with user needs. Driven primarily by private sector coordination, with some support from public programs, AgroMall's experience reflects both the benefits and the constraints of digital agriculture platforms, underscoring the vital role of seamless payments, gender sensitive design, and interoperability in achieving long term success.

3.6. Digitalizing Wage Payments in Assam's Tea Sector

The case of Assam's tea sector in India highlights how policy mandates and partnerships may fail to deliver digital payment adoption when foundational enablers are lacking. In 2017, as part of the national Digital India programme, the Government of India mandated that all 841 registered tea estates in Assam shift from cash-based wage disbursements to bank transfers. To facilitate this transition, the Assam state government partnered with several key actors: the State Bank of India (SBI) to facilitate account openings for tea workers; with RailTel Corporation of India to extend broadband connectivity to remote tea-growing regions; and with the Tea Association of India (TAI) to establish customer service points for digital transactions (BTCA, 2021). To incentivize participation, workers also received monetary bonuses deposited into their new accounts.

Despite these measures, adoption remained extremely limited. By 2019, only 28 estates (just 3 percent) had begun disbursing wages through bank transfers (Karmakar, 2019; BTCA, 2021). The initiative was undermined by a combination of interrelated barriers. The region's hilly terrain and weak telecommunications infrastructure led to transaction failure rates as high as 50 percent. Strict Know-Your-Customer (KYC) regulations rendered approximately 30 percent of newly opened accounts non-functional, as many workers lacked the required identification documents. Moreover, widespread preference for cash, particularly among the predominantly female workforce, who made up around 60 percent of all tea workers, coupled with low levels of digital literacy, further discouraged uptake (Karmakar, 2019; BTCA, 2021).

This case underscores the limitations of top-down digitalization efforts in the absence of enabling infrastructure and user-centered implementation. While policy mandates and institutional partnerships are critical components, they must be complemented by parallel investments in rural connectivity, simplified and inclusive account registration processes, and reliable last-mile cash-in/cash-out infrastructure. Without addressing these systemic barriers, digital payment reforms are unlikely to gain traction in remote, cash-dependent value chains.

4. ENABLING AND LIMITING FACTORS IN THE DIGITALIZATION OF AGRI-FOOD VALUE CHAINS

The case studies and examples reviewed highlight a range of enabling and limiting factors impacting the digitalization of payments within agri-food value chains. Across diverse geographic and value chain contexts, certain conditions repeatedly emerged as critical determinants of success or failure, offering valuable insights for future digitalization initiatives. These are summarized thematically in Table 1, which organizes the factors under key domains such as infrastructure, policy, partnerships, service design, user engagement, and gender inclusion.

A key enabling factor consistently identified is the existence of robust mobile money infrastructure, exemplified by Kenya's M-PESA. The extensive and mature agent network, regulatory flexibility, and high levels of mobile money penetration created a conducive environment for innovative applications such as the Connected Farmer platform. The success of M-PESA underscored how foundational infrastructure, combined with a user-friendly platform and supportive regulatory frameworks, significantly boosts adoption rates and sustainability (Mas and Morawczynski, 2009; Mas and Radcliffe, 2010; Technoserve, 2016). However, digitizing payments at isolated points in the value chain is not sufficient to drive widespread adoption. Real impact depends on the development of a broader digital ecosystem, one in which farmers and midstream actors can reliably access, spend, and receive digital payments across a range of transactions. This requires not only payment infrastructure but also the availability of goods and services that can be purchased digitally, reducing the need for cashing out and reinforcing the utility of digital tools (Denyes et al., 2018; BTCA, 2020a).

Multi-stakeholder coordination consistently emerged as a critical success factor. Creating a clear understanding across the entire value chain of the benefits of digitization is also essential for increasing acceptance and uptake among various actors (BTCA, 2020a). Successful digital payment initiatives, such as Cargill's cocoa premium digitalization in Côte d'Ivoire, Ghana, and Cameroon, depended heavily on collaboration among agribusinesses, financial institutions, mobile network operators, and government agencies (Denyes et al., 2018; BTCA, 2020b, 2020a; Cargill, 2023). Clearly defined partner roles, alignment of private and public sector interests, and effective coordination were essential to overcoming barriers such as documentation requirements, rural network coverage, and user literacy (Denyes et al., 2018). In Rwanda, sector-wide digitalization of tea sector payments similarly benefited from strong government policy support, effective cooperation among tea factories, cooperatives, Savings and Credit Cooperative Organizations (SACCOs), and financial service providers, enabling the digital ecosystem to achieve meaningful operational efficiencies and farmer adoption (BTCA, 2023b). However, it is important to note that someone must take on the role of coordinator, and the incentives to do so vary. In Cargill's case, the private sector led coordination, motivated by clear business benefits such as improved traceability, reduced cash-handling risks, and stronger supplier relationships. Similarly, in Kenya, the Connected Farmer initiative benefited from Safaricom's infrastructure and Kenya Nut's operational incentives

to streamline procurement. In contrast, Rwanda's tea sector digitalization was led by the government, which had a broader policy agenda to promote a cashless economy and improve transparency in rural payments. These examples underscore that successful coordination requires not only alignment among stakeholders but also a clear incentive for at least one actor to lead and sustain the effort. Where such leadership is absent or poorly defined, as seen in less successful cases, coordination gaps can undermine implementation and limit adoption.

Bundled services emerged as another key enabling factor, often improving farmer uptake by creating clear, tangible benefits beyond merely replacing cash transactions. Integrated agritech platforms such as AgroCenta's CropChain and LendIt in Ghana, as well as AgroMall's TellAgri and AgroWallet platforms in Nigeria, combined digital payments with input financing, crop insurance, and digital advisory services. While these bundled offerings enhanced the overall value proposition for farmers and agribusinesses, actual adoption patterns varied. For instance, AgroMall saw widespread farmer profiling and advisory enrollment, but most farmers used the payment system only once. Similarly, AgroCenta reported increased inclusion and service access, but platform restructuring and stagnant registration suggest limited long-term engagement. These cases illustrate that while bundling can strengthen service appeal, it does not guarantee sustained use of digital payments without addressing underlying barriers such as infrastructure, transaction costs, trust, and interoperability (GSMA, 2019, 2023; Von Bismarck-Osten, 2021).

The role of supportive government policies and regulatory environments cannot be overstated. Rwanda's government-backed Vision 2050 cashless economy initiative significantly accelerated digital adoption in the tea sector (BTCA, 2023b). Similarly, Kenya's regulatory flexibility, characterized by a "test-and-learn" approach, played a decisive role in the rapid adoption and innovation surrounding mobile money services, enabling initiatives like Connected Farmer to quickly adapt and scale (Mas and Radcliffe, 2010; Technoserve, 2016). In contrast, restrictive regulatory frameworks, such as Nigeria's bank-led mobile money model and the mobile money taxation introduced in Uganda, have constrained DFS expansion and posed significant barriers for initiatives such as AgroMall and Kyagalanyi Coffee (Nair and Varghese, 2020).

Despite notable successes, several barriers consistently hindered broader digital adoption. Foremost among these were infrastructural limitations, particularly poor rural connectivity, insufficient agent liquidity, and limited mobile network coverage. Farmers in Kenya, Ghana, and Nigeria frequently cited poor connectivity and agent liquidity constraints as significant challenges (Technoserve, 2016; Von Bismarck-Osten, 2021; GSMA, 2023). These issues severely limited the practical usability of digital payments, leading many farmers to revert to cash transactions.

Gender disparities consistently emerged as significant barriers to digital financial inclusion. Women farmers face substantial exclusion due to lower rates of mobile ownership, limited access to formal identification, lower digital literacy, and restrictive social norms. These barriers were especially pronounced in the Rwanda tea sector, where most women required assistance to use digital services effectively (BTCA, 2023b). Similarly, gender gaps in loan access were evident in Nigeria's AgroMall initiative, reflecting broader systemic barriers faced by women in accessing digital financial services (GSMA, 2023). Initiatives such as TruTrade in Kenya and Uganda highlight the necessity of targeted interventions, such as tailored account-opening campaigns and gender-sensitive financial literacy training, to bridge the gender digital divide effectively (GSMA, 2022).

High transaction costs, particularly withdrawal fees, consistently deterred farmer adoption of digital payment solutions. Smallholder farmers typically handle smaller transaction values, making them disproportionately sensitive to fees associated with digital withdrawals. In the cases of Connected Farmer and

AgroMall, withdrawal fees significantly dampened initial farmer enthusiasm, despite broader recognition of the security and efficiency benefits of digital payments (Technoserve, 2016; GSMA, 2023).

Trust and behavioral acceptance also represented persistent barriers. Farmer mistrust in digital systems, stemming from withdrawal difficulties, perceived risks of fraud, and limited digital financial literacy, initially limited adoption across multiple contexts, including Kenya's Connected Farmer, Ghana's AgroCenta, and Nigeria's AgroMall initiatives. Overcoming this barrier required extensive farmer education, sensitization campaigns, and sustained field presence by trusted agents and agronomists (Technoserve, 2016; Von Bismarck-Osten, 2021; GSMA, 2023).

Additional case studies beyond the core examples highlight similar challenges and enabling factors. SmartMoney's localized 'E-Villages' model in Tanzania aimed to foster local digital acceptance but faced infrastructural constraints (CTA, 2019). Meanwhile, Olam International's digitalization efforts in Indonesia demonstrated significant challenges due to farmers' strong preference for cash and limited rural agent infrastructure, highlighting persistent global barriers to digitalization (Nair and Varghese, 2020). While these examples are mentioned to illustrate broader trends, the case studies selected for deeper analysis were chosen solely based on the availability of detailed, publicly accessible information on their impacts and outcomes.

Table 1: Key Enabling and Limiting Factors for Payment Digitalization in Agri-Food Value Chains

Theme	Enabling Factors	Limiting Factors	Sources
Infrastructure	Robust mobile money infrastructure; mature agent networks (e.g., M-PESA); availability of digital goods/services	Poor rural connectivity; insufficient agent liquidity; limited mobile network coverage	(Mas and Morawczynski, 2009; Mas and Radcliffe, 2010; Technoserve, 2016; Von Bismarck-Osten, 2021; GSMA, 2023)
Policy & Regulation	Supportive regulation (e.g., "test-and-learn" in Kenya); government cashless economy push (e.g., Rwanda's Vision 2050)	Restrictive models (e.g., bank-led DFS in Nigeria); poorly sequenced mandates (e.g., Assam tea)	(Mas and Radcliffe, 2010; Nair and Varghese, 2020; BTCA, 2021, 2023b; GSMA, 2023)
Partnerships & Coordination	Strong multi-stakeholder coordination (agribusinesses, mobile money operators, FSPs, governments, cooperatives); clear incentives for a lead actor; cross-value chain understanding	Coordination gaps; unclear partner roles; misaligned incentives: lack of a leading actor	(Denyes *et al.*, 2018; BTCA, 2020b, 2020a, 2021, 2023b; Cargill, 2023)
Product & Service Design	Bundled services (e.g., input loans, insurance, advisory); user-centered design	Lack of interoperability; high transaction and withdrawal costs; limited functionality of e-wallets	(Technoserve, 2016; GSMA, 2019, 2023; Von Bismarck-Osten, 2021)
User Engagement & Trust	Agent-led onboarding; financial literacy training; trusted local presence	Mistrust in digital systems; low digital literacy	(Technoserve, 2016; Von Bismarck-Osten, 2021; GSMA, 2023)
Gender Inclusion	Dedicated outreach; gender-sensitive training (e.g., TruTrade campaigns)	Gender gaps in mobile ownership, literacy, and access; male-dominated agent networks; gendered barriers in loan access	(GSMA, 2022, 2023; BTCA, 2023b)

5. CONCLUSION

The case studies and examples reviewed in this report highlight that successful digitalization of payments in agri-food value chains depends not only on technology but on a holistic interplay of infrastructure, policy, partnerships, service design, user engagement, and gender inclusion. Strong mobile money infrastructure and mature agent networks, as demonstrated by Kenya's M PESA, create a conducive foundation for digital payments. Yet, widespread adoption emerges only when digital payments are embedded within a broader ecosystem that allows farmers and midstream actors to reliably access, spend, and receive digital payments across a range of transactions. In this context, multi stakeholder coordination, whether led by private firms like Cargill and Kenya Nut or by government driven efforts like Rwanda's tea sector digitalization, is vital for aligning incentives, addressing bottlenecks, and sustaining momentum. Bundled services that combine payments with value adding inputs such as credit, insurance, and advisory services can further deepen engagement, although their long-term success depends on resolving persistent barriers related to connectivity, transaction costs, trust, and interoperability.

The evidence also underscores the pivotal role of supportive policies and regulatory environments. Kenya's "test and learn" approach accelerated mobile money innovation, while Rwanda's Vision 2050 created strong incentives for digitalization. In contrast, restrictive frameworks and taxes in Nigeria and Uganda limited the expansion of digital services. Importantly, structural barriers, including rural connectivity, agent liquidity, high withdrawal fees, and gender gaps in mobile access and literacy, continue to impede inclusive digital adoption across diverse settings. Addressing these constraints requires intentional design and targeted interventions, especially for women and other underserved groups, coupled with ongoing farmer education and trust building efforts.

Future digitalization efforts must integrate these lessons by leveraging proven enablers while tackling systemic bottlenecks to create resilient and inclusive digital ecosystems. By aligning infrastructure, policy, service design, and user centered support, stakeholders can transform digital payments from isolated point solutions into widespread, trusted platforms that deliver lasting benefits for farmers, agribusinesses, and rural communities alike.

ABOUT THE AUTHORS

Julia Wagner is a Research Analyst, Alan de Brauw and Kate Ambler are Senior Research Fellows, and Jeffrey R. Bloem is a Research Fellow in the Markets, Trade, and Institutions Unit at the International Food Policy Research Institute (IFPRI).

REFERENCES

Adeniyi, A. and Obodoekea, P. (2020) Digitalization of Last Mile Aggregation and Logistics Services to Enhance Market Access of Farm Produce Towards Reducing Post-Harvest Loss and Achieving Value Chain Improvement: Making a Case for Improved Income for Smallholder Farmers and Making Rural Economy Work for the Poor. Available at: https://theagromall.com/web_media/pdf/666604024.pdf.

Ambler, K. et al. (2023) 'Viewpoint: Finance needs of the agricultural midstream', Food Policy, 121, p. 102530. Available at: https://doi.org/10.1016/j.foodpol.2023.102530.

Aron, J. (2018) 'Mobile Money and the Economy: A Review of the Evidence', The World Bank Research Observer, 33(2), pp. 135–188. Available at: https://doi.org/10.1093/wbro/lky001.

Beaman, L. et al. (2014) Self-Selection into Credit Markets: Evidence from Agriculture in Mali. Working Paper 20387. National Bureau of Economic Research. Available at: https://doi.org/10.3386/w20387.

BTCA (2020a) Digitizing Payments in Ghana's Cocoa Supply Chain. Four Building Blocks for Responsible and Scalable Digitization.

BTCA (2020b) The Hidden Costs of Cash to Ghana's Cocoa Sector.

BTCA (2021) Digital Payments in Agriculture: India Learning Series. Available at: https://www.youtube.com/watch?v=H7jNN2wnjso.

BTCA (2023a) Pocket Guide: Responsible Payment Digitization in the Coffee Value Chain.

BTCA (2023b) Scaling up Responsible Digital Payments in the Rwandan Tea Sector.

Cargill (2023) 2023 ESG Report.

CTA (2019) The Digitalisation of African Agriculture Report 2018-2019.

Demirgüç-Kunt, A. et al. (2022) The Global Findex Database 2021: Financial Inclusion, Digital Payments, and Resilience in the Age of COVID-19. The World Bank. Available at: https://doi.org/10.1596/978-1-4648-1897-4.

Denyes, L. et al. (2018) The Digital Financial Services for Agriculture Handbook. Washington, D.C.: World Bank Group. Available at: http://documents.worldbank.org/curated/en/461421559326915086.

GSMA (2019) Ecosystem Accelerator Compass: Insights on Start-ups and Mobile in Emerging Markets, Issue 6. Available at: https://www.gsma.com/solutions-and-impact/connectivity-for-good/mobile-for-development/wp-content/uploads/2019/11/AgroCenta-Empowering-smallholder-farmers-through-finance-information-and-market-access.pdf.

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

GSMA (2022) Reaching and Empowering Women with Digital Solutions in the Agricultural Last Mile. Available at: https://www.gsma.com/solutions-and-impact/connectivity-for-good/mobile-for-development/wp-content/uploads/2022/05/Agri-Women-in-Value-Chains-v5.pdf.

GSMA (2023) Improving Farmer Livelihoods Through Digitised Agricultural Value Chains. Results and lessons from the GSMA Innovation Fund.

IPA (2022) Measuring the True Cost of Digitial Financial Services in Tanzania.

Karmakar, S. (2019) 'Digital India initiative "flops" in Assam tea gardens'. Available at: https://www.deccanherald.com/india/digital-india-initiative-flops-in-assam-tea-gardens-756301.html.

Mas, I. and Morawczynski, O. (2009) 'Designing Mobile Money Services Lessons from M-PESA', Innovations: Technology, Governance, Globalization, 4(2), pp. 77–91. Available at: https://doi.org/10.1162/itgg.2009.4.2.77.

Mas, I. and Ng'weno, A. (2010) 'Three Keys to M-PESA's Success: Branding, Channel Management and Pricing', SSRN Electronic Journal [Preprint]. Available at: https://doi.org/10.2139/ssrn.1593387.

Mas, I. and Radcliffe, D. (2010) Mobile Payments go Viral: M-PESA in Kenya. Washington, D.C.: World Bank. Available at: http://documents.worldbank.org/curated/en/638851468048259219.

Nair, A. and Varghese, M.M. (2020) Digitization of Agribusiness Payments in Africa : Building a Ramp for Farmers' Financial Inclusion and Participation in a Digital Economy. Washington, D.C.: World Bank Group. Available at: http://documents.worldbank.org/curated/en/915271601013162558.

Parlasca, M.C., Johnen, C. and Qaim, M. (2022) 'Use of mobile financial services among farmers in Africa: Insights from Kenya', Global Food Security, 32, p. 100590. Available at: https://doi.org/10.1016/j.gfs.2021.100590.

Restropo, M.C.G. et al. (2023) Mapping climate and agronomic digital advisory services landscape of the Transforming Agrifood Systems in West and Central Africa Initiative (TAFS-WCA): A case of Ghana. Available at: https://doi.org/10.4160/cip.2024.12.011.

Suri, T. et al. (2023) 'Mobile Money', VoxDevLit, 2(2). Available at: https://voxdev.org/voxdevlit/mobile-money.

Technoserve (2016) Connected Farmer Alliance: Assessing the impact of a commercial mobile agriculture (mAgri) solution.

Turner, E., Al-Saidi, H. and Yadav, R. (2024) Digital Agriculture Services in Kenya: The Farmer Perspective. 60 Decibels.

Vaughan, P., Fengler, W. and Joseph, M. (2013) 'Scaling Up through Disruptive Business Models: The Inside Story of Mobile Money in Kenya', in L. Chandy et al. (eds) Getting to Scale. Brookings Institution Press (How to Bring Development Solutions to Millions of Poor People), pp. 189–219. Available at: http://www.jstor.org/stable/10.7864/j.ctt4cg7vg.10 (Accessed: 6 March 2025).

Von Bismarck-Osten, M. (2021) 'Understanding Strategic Decisions of Digital Agricultural Platform Companies: Six Case Studies of Sub-Saharan African Platforms', SSRN Electronic Journal [Preprint]. Available at: https://doi.org/10.2139/ssrn.3849193.

Were, N. (2017) 'Making Digital Payments Work for Low-Income Farmers', 16 October. Available at: https://www.cgap.org/blog/making-digital-payments-work-for-low-income-farmers (Accessed: 18 June 2025).

 Funding for this work was provided by the Gates Foundation.

INTERNATIONAL FOOD POLICY RESEARCH INSTITUTE

A world free of hunger and malnutrition

IFPRI is a CGIAR Research Center

1201 Eye Street, NW, Washington, DC 20005 USA | T. +1-202-862-5600 | F. +1-202-862-5606 | Email: ifpri@cgiar.org | www.ifpri.org | www.ifpri.info