CGAP

FOCUS NOTE

Serving Smallholder Farmers: Recent Developments in Digital Finance

No. 94
June 2014

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An estimated 500 million smallholder farming families (representing more than 2 billion people) rely to varying degrees on agricultural production for their livelihoods.[1] As the largest global segment by livelihood of those living on less than US$2 a day, smallholder families are central to global financial inclusion efforts—but reaching smallholders with financial services is challenging.

Most agricultural production is by nature seasonal, with time passing between cash outflows and inflows. Farming depends on the quality of the resource base (such as seeds and fertilizers); it is vulnerable to pests and spoilage; and it is exposed to volatile weather and prices. Financial service providers face liquidity management and concentration challenges due to covariant risks—farmers in the same area generally borrow at the same time and often engage in the same activities, and are therefore exposed to the same risks. Providers often require greater incentives to work in remote rural areas, where sparse populations with low financial capability and weak infrastructure result in higher transaction costs.

Conventional approaches to financial services for smallholders have historically focused on one product (credit) for one purpose (agricultural production). Agricultural credit is gradually evolving from supply-driven, subsidized credit provided by public-sector institutions to demand-driven credit supplied by a range of providers. This evolution began when processors started providing credit for production and subtracting repayment from the purchase price of the product. Over time, this developed into a more comprehensive approach encompassing the entire agricultural value chain. The tight link with the market served as a collateral substitute, thereby helping to address one of the primary barriers to private-sector credit to smallholders: lack of physical collateral such as a land title deed. However, the advances in value chain finance[2] are estimated to reach only 7 percent of the world's smallholder farmers, the vast majority of whom remain noncommercial or only loosely connected to value chains (Christen and Anderson 2013). The focus on agricultural credit also obscures the fact that smallholders have various financial needs as consumers and often have diverse nonagricultural revenue sources—giving rise to a wide range of required financial services, including insurance, savings, and payments.

A number of private-sector actors and other stakeholders are experimenting with digital financial services (DFS), particularly those enabled by mobile phones, to overcome the specific challenges of serving smallholder farmers and their families.[3] Buoyed by the relative success of DFS in the nonagricultural context,[4] a range of DFS deployments has been launched in recent years aimed at going the "last mile" to extend financial services to smallholders.[5] The efforts are still nascent and the challenges plentiful—but there is widespread commitment to exploring the potential of DFS to overcome a number of traditional "pain points" that currently limit smallholder use of formal financial services. (See Figure 1 and Figure 2 for examples of how DFS can help meet smallholder financial needs).

This Focus Note introduces some recent developments in this rapidly changing space. The featured case studies *(i)* identify traditional pain points in serving smallholder farmers (such as the

1 Includes crop, livestock, and fisheries. IFAD's 2010 estimate of holders of less than 10 agricultural hectares, based on FAO World Census of Agriculture and UNDESA Rural Population data. An estimated 446 million holders had less than two agricultural hectares.

2 Value chain financing encompasses "any or all of the financial services . . . flowing to and/or through a value chain to address the [financial] needs and constraints of those involved in that chain . . . ." Value chain financing can be internal (such as the provision of credit to farmers by commodity buyers) or external (such as bank loans offered on the strength of warehouse receipts). For a broad discussion on value chain finance, see Miller and Jones (2010).

3 See, for example, Statham, Pfeiffer, and Babcock (2013). See also CTA Technical Center for Agricultural and Rural Cooperation (2014).

4 A recent GSMA survey found that the largest mobile money service providers recorded over 58 million domestic person-to-person (P2P) transfers valued at over US$2 billion in June 2013. See http://www.gsma.com/mobilefordevelopment/wp-content/uploads/2014/02/SOTIR_2013.pdf. In Brazil in 2012, financial services agents processed 2.4 billion bill payments and over 670 million deposits or withdrawals. See Banco Central do Brasil website at http://www.bcb.gov.br/?SPBADENDOS. And in Kenya, a recent survey estimated that 62 percent of adults actively use mobile money services. See InterMedia Kenya FII Tracker survey (preliminary results from survey conducted from September to October 2013, results not yet validated).

5 CGAP maintains an online database of selected examples of DFS deployments in agriculture and other development sectors. See https://docs.google.com/spreadsheet/ccc?key=0AmLodop1Cr1ldDdiUGFjRG44d2V1Y0VBWVdVM0IyNnc&usp=sharing#gid=0.

Figure 1. How DFS could improve smallholder access to inputs

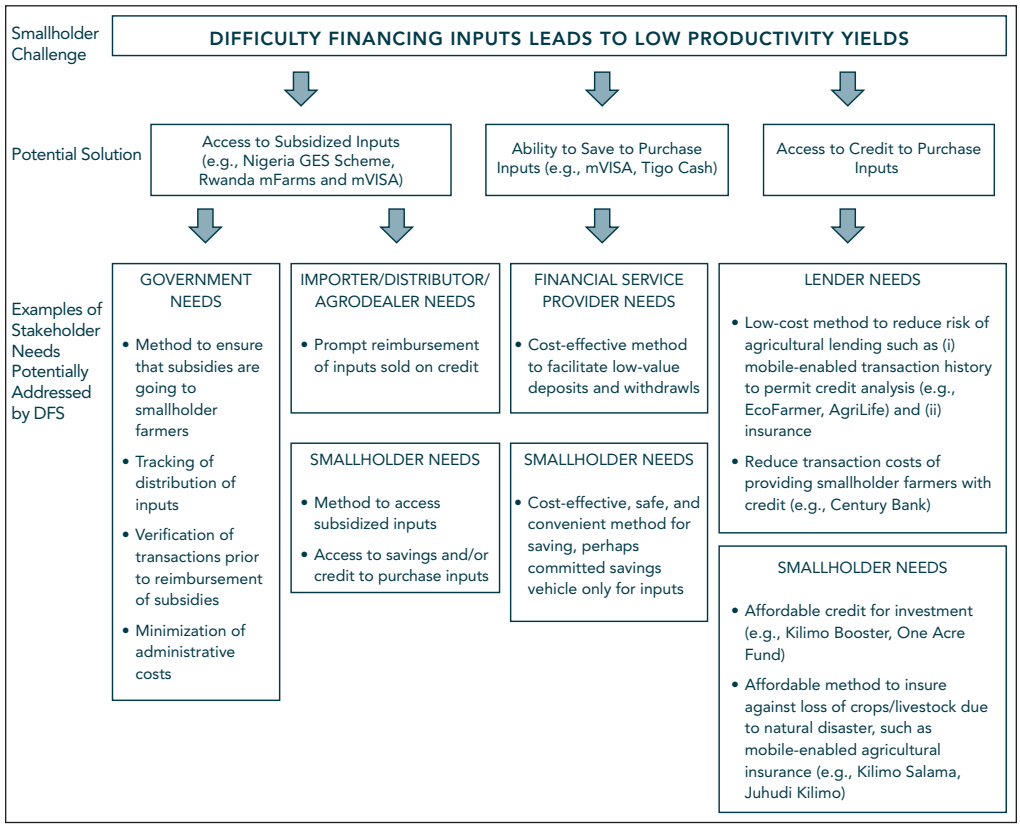
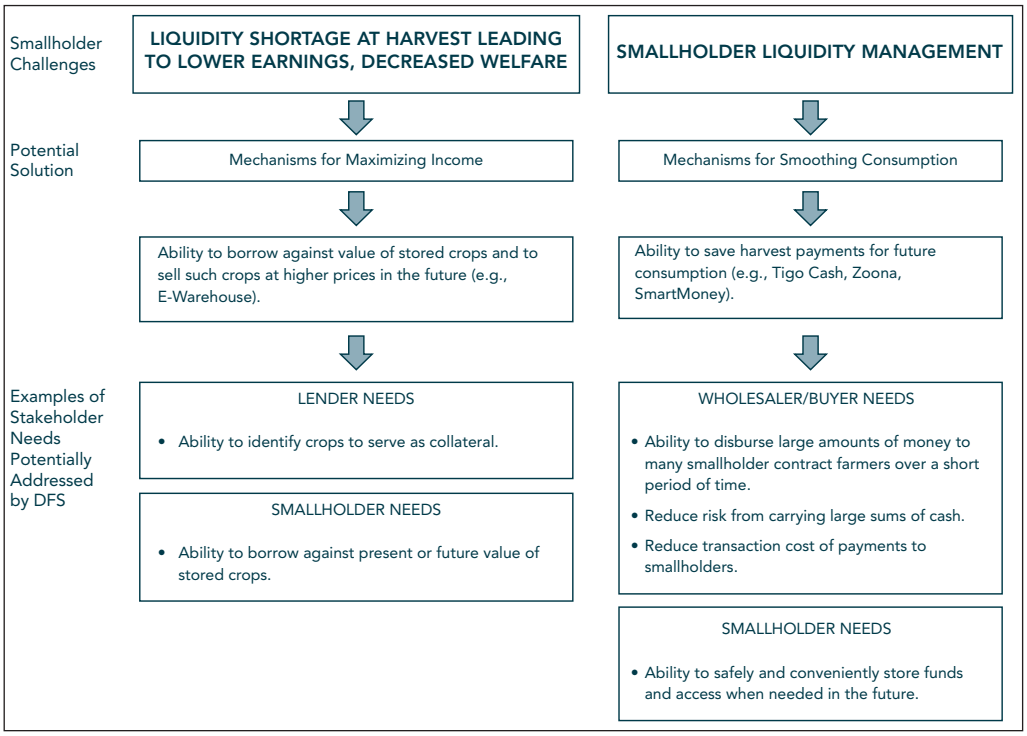


Figure 2. How DFS could mitigate smallholder liquidity challenges



cost and risk of making payments to farmers and delivering subsidized credit), *(ii)* discuss how DFS are being used to overcome these pain points, and *(iii)* highlight some initial obstacles and successes.

Given the embryonic and rapidly developing state of DFS for smallholders, it is too early to draw clear conclusions from the examples to date. Initial evidence suggests, however, that while DFS via mobile channels offer great promise for improving the lives of smallholders and their families, significant challenges remain. One key obstacle is the lack of mobile phone penetration and network coverage, suggesting that different forms of technology also should be considered. Furthermore, smallholders' receptiveness to DFS via mobile channels in the case study countries appears to vary depending on their experience with mobile phones in general and with mobile money services in particular. This suggests that the success of mobile-enabled DFS may depend in large part on factors such as nationwide mobile money adoption and smallholders' experience using mobile phones for services such as voice, messaging, and agricultural information.

In addition, early evidence suggests that DFS innovations tailored to the agricultural context—while benefitting smallholders—often are driven by the interests not of smallholders but of other parties, such as governments seeking to reduce costs of cash subsidies or commodity buyers seeking to reduce costs and risks associated with cash payments. Future efforts should focus on complementing current DFS innovations with other innovations that are based more solidly on the financial needs, behaviors, and aspirations of smallholder families.

1. Crop Payments in Ghana: Reducing Cost and Risk, Improving Smallholder Liquidity Management

Many smallholder farmers around the world have relationships with buyers who provide credit to purchase inputs (and sometimes labor) in exchange for a promise to sell their crops upon harvest. Since most smallholders lack access to formal financial accounts and services, they are typically paid in cash. This system has a number of weaknesses. From the perspective of the buyer, distributing cash payments to thousands of unbanked farmers is costly and dangerous. Cash disbursement also poses security and liquidity management problems for the farmers. They typically receive several months' worth of income (and possibly more) in one day. Since these funds often are stored at home, farmers run the risk of being robbed or losing the money in the event of a fire or other disaster. In many rural communities cash payments are typically made publicly in front of the entire community, so everyone knows how much each family has earned. This lack of privacy makes it even more difficult for low-income farmers to smooth consumption and save, since an expectation to lend financial support to relatives may be part of the local culture. (See Box 1.)

Efforts at digitizing financing for inputs are being tested around the world, including in Ghana where migrating low-income farmers to traditional bank accounts has proven challenging. With only five commercial bank branches per 100,000 Ghanaians, access to banking institutions is limited, particularly in rural areas.[6] As of

Box 1. Smallholder Challenge: Liquidity Management

Potential Solution: Mechanism for Smoothing Consumption

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Ability to save harvest payments for future consumption.

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WHOLESALER/BUYER NEEDS

Ability to disburse large amounts of money to many smallholder contract farmers over a short period of time.

Reduce risk from carrying large sums of cash.

Reduce transaction cost of payments to smallholders.

SMALLHOLDER NEEDS

Ability to safely and conveniently store funds and access when needed in the future.

6 See World Bank, Global Financial Inclusion (Global Findex) Database.

2011, only about 25 percent of rural Ghanaians and 15 percent of low-income Ghanaians maintained accounts in formal financial institutions, according to the World Bank Global Findex.

Commodity Payments in Ghana Using Digital Financial Services

Tigo, a mobile network operator (MNO), is working with commodity buyers and nonprofit organizations to use Tigo Cash mobile wallets to tackle the challenges of cost and safety in making payments to smallholder farmers—while helping smallholders manage their liquidity.

Tigo is rolling out services in four value chains: cocoa (national rollout), rice (pilot), rubber (about to pilot), and maize (prepilot). Following a 2013 pilot with 200 cocoa farmers, a program based in the Ashanti region now plans on moving more than 10,000 cocoa farmers onto Tigo Cash payments. A number of rice buyers are also working with Tigo Cash. One such buyer, GADCO, currently is piloting Tigo Cash with approximately 1,000 farmers. If the pilot is successful, GADCO hopes to pay more than 5,000 rice farmers with Tigo Cash by 2018.

Due to the costs and risks inherent in cash payments, commodity buyers are eager to outsource payments to Tigo. Buyers pay a fee (a small percentage of the value transferred) to Tigo, which is responsible for ensuring that funds are transferred and that agents maintain sufficient liquidity to meet any farmer cash-out requirements.[7] This arrangement also transfers the risks of fraud and theft from the buyers to Tigo and its agents. For GADCO, its primary reason for shifting farmers to mobile payments was to eliminate its risk of being robbed when delivering cash payments.

Early evidence from the pilot projects suggests that farmers also are eager to adopt Tigo Cash. While the system was designed to give farmers the option to use an electronic voucher to cash out at a Tigo Cash agent without opening a Tigo Cash wallet, most farmers in the cocoa pilot elected to set up a Tigo Cash account. In addition, the cocoa pilot demonstrated that most farmers do not withdraw 100 percent of the funds immediately, instead choosing to use some of their Tigo Cash for airtime top-ups and person-to-person (P2P) transfers. For example, in one payment to cocoa farmers, approximately two-thirds sent a P2P payment, while only 10 percent cashed out immediately. Furthermore, over 85 percent of these farmers eventually cashed in, suggesting that Tigo Cash wallets could help fulfill latent demand for more formal savings services. However, in the rice pilot, use of Tigo Cash was mixed—with rain-fed rice farmers largely cashing out while irrigated-rice farmers did not. The critical difference is that payouts for rain-fed rice were relatively low given lack of rain and low crop yields. Nevertheless, both pilots demonstrate that given sufficient payouts, farmers will use Tigo Cash to store funds, thereby facilitating consumption smoothing and savings and possibly reducing the risk of families running out of money before the next harvest.[8]

As for Tigo, it has seen major benefits beyond the fees that it receives for facilitating these payments. In an initial pilot with cocoa farmers, only 3 percent had a Tigo SIM prior to the pilot, but most farmers chose to obtain a Tigo SIM to transact on the mobile wallet platform. In addition, Tigo is using the opportunity to cross-sell other products to farmers, including Family Care Insurance, Tigo's mobile-enabled life insurance product. However, in rural locations where Tigo coverage is limited, farmers are more reluctant to obtain Tigo SIMs (see Supply-Side Challenges, infra.).

Challenges

While mobile phone-enabled commodity payments have generated enthusiasm in Ghana, Tigo and its partners have experienced a number of demand and supply challenges during the pilot and rollout phases.

Demand-Side Challenges

Initially, Tigo and its partners had to address lack of farmer awareness and understanding of mobile money

7 For a general discussion on challenges of managing agent liquidity, see Flaming, McKay, and Pickens (2011). For a broader discussion of the role of agents in facilitating access to financial services, go to the CGAP website at http://www.cgap.org/topics/agent-networks.

8 There is anecdotal counter-evidence, however. A farmer near Kisumu, Kenya, who uses M-PESA to repay a supplier for inputs he received, was asked why he did not keep a balance in his M-PESA wallet. He responded, "It's too easy to spend money with M-PESA. In the rural areas, there is little to spend cash on so if I want to save, I save in cash."

services. Most farmers were unaware of mobile money, which is not surprising since, as of early 2014, only about 8 percent of Ghanaian adults were active mobile money users.[9] Given their limited margin for error, smallholder farmers tend to be cautious about adopting new products. Therefore, Tigo needed to establish trust—and so it partnered with nonprofit organizations such as Agribusiness Systems International (ASI), a subsidiary of Agriculture Cooperative Development International/ Volunteers in Overseas Cooperative Assistance (ACDI/ VOCA) that provides technical assistance to build the capacity of farmers and agribusinesses. As a trusted third party with ties to smallholder rice farmer communities, ASI was able to leverage its relationship with farmers to sensitize them to the benefits of receiving payments via Tigo Cash.

Once farmers had expressed their interest in mobile money services, proper training was required. Key training challenges related to illiteracy and financial capability. About 30 percent of the target farmers were illiterate, and most farmers had limited experience with formal financial services and no knowledge of electronic money. In addition to conducting trainings, Tigo appointed Tigo Cash "ambassadors" (community members who receive small gifts such as souvenir t-shirts) to support users, and it relied in part on help from community youth who are literate and technologically savvy. With respect to financial literacy, Tigo and its agents spent a lot of time explaining the concept of e-money and the importance of remembering and protecting personal identification numbers (PINs). Tigo found that role-playing with prospective customers proved to be particularly effective in rural areas and that trainings should be conducted no more than one week before the first payments to ensure that participants are able to remember and apply the concepts properly.

Supply-Side Challenges

Network coverage has posed a challenge in some rural areas. As a result, some farmers appear to be reluctant to activate SIMs in areas where Tigo's coverage is limited. At present, this is a greater concern in northern Ghana and among cocoa farmers, who tend to live in more remote areas. While this will continue to be a challenge in the short term, Tigo has plans to expand coverage in many such areas. In addition, bringing farmers onto the Tigo network will boost subscriber numbers in rural areas, which should justify investments in rural network coverage.

Another supply-side challenge is ensuring sufficient agent liquidity in rural areas. Here, too, Tigo benefited from partnerships. Prior to implementation of the pilot projects, ASI mapped out farmer and agent locations and surveyed farmers to understand their financial behavior. Tigo then strengthened its agent network in these areas as needed. Tigo also works closely with partner banks to ensure adequate liquidity. Agent liquidity has been less of an issue so far, since the first two pilot projects were with cocoa farmers and rain-fed rice farmers, both of whom have relatively low incomes and predictable harvest dates. Agent liquidity is expected to pose a greater challenge in the future, however, particularly once commodities such as rubber are included, since such commodities have no distinct harvesting season and command higher payouts than that of cocoa and rice.

2. Government Subsidies for Inputs in Nigeria: Reducing Costs and Increasing Yields

To increase yields and promote food security and rural development, many countries subsidize fertilizer and seeds for many of their smallholder farmers.[10] The efforts of the Federal Government of Nigeria (FGN) provide a good case study on how the cost of administering such subsidies, a key component of financing the value chain, can be reduced through DFS. In 2011, FGN spent NGN 30 billion (approximately US$180 million) on its fertilizer subsidies. Under this scheme, FGN assumed responsibility for procurement and distribution of fertilizer by placing orders with suppliers and directing suppliers to deliver the fertilizer to the respective state governments. FGN provided a general 25 percent subsidy on the cost of the fertilizer delivered to the state governments, with

9 Based on MNO statistics provided to the Bank of Ghana (Ghana's Central Bank). MNOs often define "active user" as someone with at least one transaction per 30 days, but some MNOs in Ghana use longer periods of up to 90 days..

10 This Focus Note addresses only the digitization of farmer subsidies and does not take a position on the merit of providing government subsidies for smallholder inputs.

the intention that this would reduce the cost to smallholder farmers by 25 percent. (See Box 2.)

In practice, government distribution of fertilizer was inefficient, expensive, and rife with corruption. Without effective oversight mechanisms, some public officials channeled fertilizer to political allies. Many private-sector stakeholders used their political connections to obtain subsidized fertilizer and sell it at unsubsidized prices.[11] As a result, the subsidy program severely hampered the ability of legitimate private-sector actors to develop well-functioning markets and value chains for fertilizer sale and distribution. Furthermore, Nigeria's Federal Ministry of Agriculture and Rural Development (FMARD) estimated that only 11 percent of subsidized fertilizer actually reached smallholder farmers.[12]

The Growth Enhancement Support Scheme

In 2012,[13] FMARD launched the Growth Enhancement Support (GES) scheme to transform the delivery of fertilizer subsidies in the country. Under the GES scheme, the government's role shifted from direct procurement and distribution of fertilizer to facilitation of procurement, regulation of fertilizer quality, and promotion of the private-sector fertilizer value chain. Today, FGN and relevant Nigerian state governments each contribute 25 percent of the fertilizer cost resulting in a 50 percent subsidy provided directly to smallholder farmers.

Under the GES scheme, state and local governments are responsible for registering eligible smallholder farmers (a farmer with five or fewer hectares of farmland). Farmers manually fill out a machine-readable form, data are processed and captured in a national database, and farmers receive a unique GES ID number. If farmers have access to a mobile phone, their phone numbers are recorded during registration, and the system sends them periodic messages confirming their registration and notifying them of when and where to go to redeem their subsidy.

Registered farmers with mobile phones redeem subsidies using their own phones, while those without phones can use another phone to do so. The GES scheme assigns a certain sum of subsidy credit to each farmer; these credits are associated with the farmer's GES ID number and, if applicable, the farmer's mobile phone number. In either case, no funds are directly transferred to the farmers, so farmers can use the service without registering for a mobile wallet. Registered farmers with phones receive an SMS message that they have received their subsidy and can visit their local Agro Dealer Redemption Center[14] to purchase their inputs. Generally speaking, registered farmers without phones will realize that it is time to redeem

Box 2. Smallholder Challenge: Difficulty Financing Inputs Leads to Low Productivity Yields

One Solution: Access to Subsidized Inputs

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GOVERNMENT NEEDS

Method to ensure that subsidies are going to smallholder farmers.

Tracking of distribution of inputs.

Verification of transactions before subsidy reimbursement.

Minimization of administrative costs.

IMPORTER/DISTRIBUTOR/AGRODEALER NEEDS

Prompt reimbursement of inputs sold on credit.

SMALLHOLDER NEEDS

Method to access subsidized inputs.

Access to savings and/or credit to purchase inputs.

11 Nigerian Minister of Agriculture and Rural Development Akinwumi Adesina stated on 23 August 2013: "To put it bluntly: government was not subsidizing farmers; instead it was subsidizing corruption. Farmers' powerlessness worsened as high quality seeds and fertilizers they need to raise their farm productivity were taken over by the elite, the rich and politically powerful. For the few fortunate farmers that got fertilizers, they often got them in bowls, like beggars. Farmers lost their dignity."

12 See Miller and Jones (2010).

13 Several pilots had been regionally tested from 2008 to 2011.

14 As of mid-2013, there were 1,466 Redemption Centers nationwide. See Aiyetan and Pindiga (2013). While Redemption Centers are supposed to be private shops, in practice, many are set up in local government warehouses due to the lack of a developed private-sector agricultural dealer infrastructure.

Table 1. Federal Fertilizer Subsidy Expenditures and Outreach, 2011–2013

	2011	2012	2013
Federal Costs (Subsidy & Administrative)	US$180 million	US$30 million	US$96 million (est.)
Number of Smallholders Benefiting	600,000–800,000	1.2 million	4.3 million
Cost per Smallholder Receiving Fertilizer	US$225–300 (est.)	US$25	US$22 (approx.)

their subsidies when other farmers within their community receive these SMS messages. At the Redemption Center, farmers pay their portion and redeem subsidies by sending an SMS[15] to the central platform requesting authorization of subsidy redemption. Farmers who did not provide a mobile phone number when registering for the service can conduct the transaction by using a phone available at the Redemption Center and supplying their GES ID number. If the transaction is successful, both the farmer and the agrodealer receive confirmation messages authorizing the subsidy redemption. For the first two years (2012–2013), this scheme was largely managed by Cellulant, a technology company licensed as a mobile payment service provider.

Initial Results of the GES Scheme

To prevent obstruction by vested interests that stood to lose from the new implementation, the GES scheme was rolled out very rapidly. The first pilot project started in November 2011 and national rollout began in March 2012. In 2012, 1.2 million smallholder farmers purchased subsidized fertilizer under the GES scheme. By year-end 2013, 8 million farmers were eligible for subsidies, of which 4.3 million farmers had obtained benefits.[16]

Compared to the prior subsidy program, the GES scheme has proven to be much more efficient and transparent. As previously noted, FGN spent NGN 30 billion (approximately US$180 million) in 2011 to subsidize fertilizer, nearly 90 percent of which never reached the intended participants. Stakeholders have estimated that 600,000–800,000 smallholders obtained subsidized fertilizer in 2011. By contrast, in 2012 FGN reached 1.2 million smallholders while spending just NGN 5 billion (approximately US$30 million) in subsidy and administrative costs. Even after including state government matching contributions of NGN 3.8 billion (approximately US$23 million), the subsidy cost per farmer dropped by over 80 percent from over NGN 37,500 (approximately US$230) in 2011 to less than NGN 7,500 (approximately US$46) in 2012. In 2013, FGN reached 4.3 million smallholders at a cost (including subsidies and administrative costs) of approximately NGN 12 billion (approximately US$96 million). (See Table 1.)

Key Challenges to the GES Scheme

While the revised GES scheme is more efficient and reaches more smallholder farmers than prior schemes, it faces a number of challenges. Some challenges are specifically related to the use of mobile phones, while others are not.

Challenges Related to the Use of Mobile Phones

- **Network Connectivity:** Network connectivity varies significantly in Nigeria, particularly in rural areas. Some farmers have been unable to redeem subsidies because of system failures due to lack of network access. One agrodealer near Abuja even recommended returning to a paper voucher-based system for this reason.
- **Access to SIM and/or Handset:** While most urban Nigerians own their own SIMs and handsets, only about half of Nigerian farmers have their own phones. Farmers who share a SIM are unable to use the mobile phone number as a unique identifier,[17] while those who share a handset may not regularly

15 Farmers may call a phone center for support if they are unable to redeem the subsidy using SMS.

16 Although 9 million farmers were registered from 2012 to 2013, only 8 million farmer accounts had been activated due to the time lag between farmer registration at the local level and the validation and uploading of farmer data to the central platform. Of the 3.7 million farmers who were eligible for subsidies but did not purchase subsidized fertilizer, it is believed that most elected not to purchase fertilizer, while some attempted to redeem subsidies but were unsuccessful.

17 While each farmer has a unique GES number, the mobile phone number is supposed to serve as a form of multifactor authentication.

receive messages sent to them. Cellulant estimates that at least 30 percent of the farmers within a particular community must have *(i)* registered with a unique SIM and working handset and *(ii)* entered all registration information correctly for there to be sufficient community awareness of the subsidy redemption location and dates within that community. Only if this critical mass is reached will farmers without phone access know when to proceed to the local Redemption Center to redeem their subsidies.

- **Other Issues:** Other reported challenges to the use of mobile phones include *(i)* lack of airtime to process redemptions via SMS at the Redemption Center; *(ii)* dead battery in the handset; *(iii)* lost or stolen handset; *(iv)* change in SIM between registration and redemption; and *(v)* nonreceipt of informational messages regarding registration and redemption.

Other Challenges

A number of other challenges unrelated to the use of mobile phones have been identified in the rollout of the GES scheme:

- **Delay between Registration and Validation of Eligibility:** The registration process still is not fully automated. While the GES scheme has moved from written registration forms to machine-readable forms, there is still a significant delay between the registration date and the date upon which the farmer becomes eligible to participate in the program. Machine-readable forms need to be transferred from the various local government units to be scanned by Data Sciences, an IT company. Once the forms are scanned, the data are transferred to Cellulant, which then uploads the data to the central platform and makes the information available at Redemption Centers. Only at this point are farmers eligible to receive subsidies.
- **Delayed Reimbursement of Suppliers:** Despite the use of mobile phones for communication with the farmer, the scheme still relies on paper records because of the lack of a fully functional electronic government ecosystem in Nigeria. Redemption Centers still use paper-based master lists, farmer registers, and transaction registers, all of which must be sent to the state Commissioner of Agriculture for certification. Once the state government signs off, these documents are sent to FMARD and then to Cellulant for reconciliation. As a result, suppliers often have to wait months before being reimbursed by the government for the subsidized portion of the fertilizer cost.
- **Consumer Protection:** Farmers still can be taken advantage of at Redemption Centers, as many are not fully literate and/or financially capable. Anecdotal evidence suggests that some dealers convince farmers to pay them to conduct transactions as third-party transactions rather than helping them to conduct the transactions themselves.
- **Identification:** Limited customer identification and verification is performed due to the absence of universal national IDs, digital photographs, and/or biometric data. In practice, mobile phones have not proven to be a reliable means of identification for the reasons noted earlier (dead batteries, lack of airtime, lost or stolen handsets, lost or changed SIM, etc.).

New Technologies

In response to these challenges, the GES scheme is experimenting with different technologies, each with different functionalities and ambitions with respect to financial inclusion. Cellulant, for example, is beginning to implement the Nigeria Agriculture Payment Initiative (NAPI), under which each farmer's biometric information will be captured using a biometric point-of-sale (POS) device and the farmer will be issued a new national identity card. The national ID will be an EMV smart card that will be linked to each farmer's GES account, enabling farmers to redeem subsidies at POS devices using their ID. This service will be able to transact offline and send transactions in batches, which should mitigate network connectivity challenges. In addition, farmers will be able to use their ID as a debit card tied to a no-frills Bank of Agriculture account, through which farmers will be

able to save and seek access to credit, insurance, and other agricultural financial services.[18] Other agricultural stakeholders also will be connected to the farmers through NAPI, including aggregators, input suppliers, agrodealers, financial institutions, and providers of agricultural information services. An initial pilot was being launched in one Nigerian state during the first half of 2014.

Consult Hyperion, another technology service provider, has been authorized to develop a pilot using NFC cards. Under the pilot, farmers in two states will be registered using tablets that collect all data electronically for same-day transfer to the central database. Officials responsible for registration will take digital photographs of the farmers and give them smart cards. As in the past, each farmer will be assigned to a particular Redemption Center, but agrodealers now will be equipped with low-cost NFC-capable Android tablets. When farmers go to their local Redemption Center, they will identify themselves by tapping the card on the tablet. The dealer will see a photo of the farmer, along with the farmer's identification and subsidy eligibility information. Transactions can be uploaded in batches whenever an online connection is established, allowing individual transactions to take place in the absence of network connectivity.

While both initiatives aim to improve the distribution of input subsidies, the approaches taken differ markedly with respect to financial inclusion. (See Box 3, for an example from Rwanda.) Consult Hyperion's scheme is specifically aimed at improving the delivery of input subsidies. With its more limited ambitions, the scheme can be rolled out more quickly and at a lower cost than the NAPI scheme. The NAPI scheme will require costlier equipment for biometric data capture, but it offers the potential for fuller financial inclusion in the future by connecting farmers to a broad range of agricultural financial services. What is notable about both schemes, however, is that due to limitations of network connectivity and handset ownership, both are moving away from the mobile phone as the primary channel for service delivery.

3. Other Digital Finance Innovations Benefitting Smallholders

The prior case studies highlighted how DFS can benefit smallholders by facilitating commodity payments, consumption smoothing, and the ability to save for and access subsidized inputs. This section introduces a number of other DFS deployments in the early stages of development, each of which is aimed at overcoming a traditional hurdle in reaching smallholders with financial services: *(i)* an electronic warehousing service aimed at facilitating access to warehouse receipt credit, *(ii)* mobile phone-enabled agricultural insurance services, and *(iii)* digital ecosystems that are using farmer transaction data to evaluate creditworthiness. (See Box 5.)

Lack of Liquidity at Harvest: e-Warehouse in Kenya

Lack of liquidity at harvest time is a major financial challenge for the world's smallholder farmers. Many smallholder farmers have little or no cash left over from the prior harvest, and therefore, go through a "hunger season" before a new harvest (Thurow 2012). The desperate need for income, however, often forces farmers to sell their crops when the market is flooded and, consequently, when prices are low. Ironically, these same farmers are often forced to purchase the same crops for their family's consumption later in the season when prices have risen. Storage warehouses allow farmers to have the quality and amount of their crops certified. They can then use this certification (called a warehouse receipt) as collateral to obtain a commercial loan. This loan permits farmers to sell their crops at a later date when supply is limited and prices have risen. However, most commercial warehouses are too distant, are too expensive, or have minimum amount requirements that prevent use by smallholders. (See Box 4.)

In Kenya, the Grameen Foundation is partnering with Farm Concern International (FCI) to develop an e-Warehouse pilot program for maize farmers. Farmers are able to store their grain at home or

18 While Bank of Agriculture is the lead bank, all Nigerian banks are connected to NAPI and will be able to offer financial services to farmers through the national ID.

Box 3. Is Rwanda's Approach to Fertilizer Subsidies More Inclusive?

Like Nigeria, Rwanda is relying on technology to improve the delivery of subsidized fertilizer to smallholder farmers. Currently, local government representatives identify eligible farmers, after which the Ministry of Agriculture and Animal Resources (MINAGRI) sends staff equipped with handheld scanners and Bluetooth printers to record each farmer's details and print paper vouchers. Farmers redeem vouchers at local agrodealers, who confirm eligibility using a master list. At the end of each season, dealers provide the vouchers and master list to the suppliers, who then claim reimbursement from MINAGRI. Currently, verification of paper vouchers is a challenge; for the first harvest season in 2014, MINAGRI rejected 21 percent of submitted vouchers for noncompliance with reporting requirements.

As in Nigeria, government officials expect that moving from paper-based to digital subsidies will lower costs, reduce fraud, and streamline the processes of registering farmers and reimbursing suppliers for redeemed subsidies. Consequently, MINAGRI is piloting efforts to replace the paper-based system with an electronic system using *(i)* mVISA, an interoperable mobile wallet, and *(ii)* mFarms, an Android-based fertilizer supply chain management system that currently is being used by agrodealers to manage their operations and is expected to eventually facilitate data sharing among MINAGRI, suppliers, and agrodealers.

The key difference between the Nigerian and Rwandan schemes is that, from its inception, Rwanda's initiative incorporates a multifunctional mobile wallet. At the beginning of the season, MINAGRI identifies eligible farmers and collects information such as their name, national ID number, mobile phone number, and the type and value of the fertilizer subsidy. MINAGRI transfers this information to Bank of Kigali and Urwego Opportunity Bank, who remotely register the farmers for mVISA, a bank-based mobile wallet service. Registered farmers receive a text message with instructions on how to set up a PIN and use their mVISA accounts, and bank staff go to the villages to sensitize and train farmers on how to use the service.

The mobile wallet provides farmers with a safe and convenient way to save, and no fees are charged for cashing-in or paying merchants, thereby facilitating digital payment of their portion of the inputs. Farmers will no longer need to bring a paper voucher to the dealer, as payment via the farmer's PIN-protected mVISA account ensures that only eligible farmers redeem subsidies. The dealer will confirm the farmer's eligibility using a master list (currently paper-based but expected to shift to electronic once MINAGRI adopts mFarms) that contains details such as the farmer's national ID number and mobile phone number. Since payments via mVISA will be easier to match to subsidy redemptions claimed on the dealer's master list, MINAGRI plans to verify and reimburse subsidies weekly.

While adoption of mVISA should help MINAGRI achieve its goals of improving input subsidy distribution, equipping farmers with mVISA wallets also offers opportunities for fuller financial inclusion. Some farmers are already using mVISA to pay utility bills and school fees. In addition, since mVISA accounts are bank-based mobile wallets, farmers are instantly connected to a licensed deposit-taking institution. In this manner, mobile wallets developed to facilitate fertilizer subsidy payments can serve as a stepping stone to full-fledged banking services, including formal savings, credit, and insurance.*

Although Rwanda's approach may offer greater potential for financial inclusion of smallholder farmers, it, too, faces challenges. Low rates of farmer uptake during the pilot largely can be attributed to insufficient awareness and training efforts due to the short timeframe for pilot implementation. These issues and technical glitches—such as receiving SMS messages in English rather than in Kinyarwanda—can be addressed with greater preparation before full rollout of services. The biggest challenge, however, to the success of Rwanda's scheme is network connectivity. As in Nigeria and Ghana, network access in rural areas can be unreliable, and some dealers are already calling for a return to paper vouchers if network connectivity does not improve.

*For more on financially inclusive G2P payments, see Bold, Porteous, and Rotman (2012).

collectively with other farmers or, in some cases, the e-Warehouse program sets up village-level warehouses.[19] The innovation behind e-Warehouse lies in Grameen Foundation's mobile-based data collection tools (TaroWorks™) that are used by trained village knowledge workers to collect and upload farmer storage information: the amount, the storage method (to indicate risk of pests or spoilage),

19 The costs of village-level warehouses are covered by FCI for the first six months before being transferred for collective management by smallholder farmer participants.

Box 4. Smallholder Challenge: Liquidity Shortage at Harvest Leading to Lower Earnings, Decreased Welfare

One Solution: Mechanism for maximizing income through ability to borrow against value of stored crops and to sell such crops at higher prices in the future.

LENDER NEEDS

Ability to identify crops to serve as collateral.

SMALLHOLDER NEEDS

Ability to borrow against present or future value of stored crops.

Box 5. Digital Ecosystems for Smallholders: Where Do Financial Services Fit?

A number of service providers see digital financial services as just one component, and perhaps even the final component, of a much broader digital ecosystem that connects all key participants in a particular value chain, including farmers, farmer groups (cooperatives and aggregators), agricultural dealers, commodity buyers, financial service providers, MNOs, and others. The ecosystem initially draws in farmers by providing, sometimes for free, access to information such as weather reports, farming tips, and market prices. Agricultural dealers would then pay a fee to target registered farmers with input advertisements. Buyers would be paid to upload information about their crop purchase transactions, thereby creating an information trail on specific farmers, what and how much they sell, and the amount of payment the farmers received. This information could be used to establish creditworthiness of farmers who typically lack any formal credit history. Financial service providers would use the farmer transaction history to sell loans and other financial products via the mobile channel. Ultimately, once the ecosystem is fully running, it would provide the rails for the related financial transactions, such as buyer payments to farmers for their crops, farmer payments for inputs, or farmer repayments of loans.

A number of these ecosystems are in the early stages of development, including EcoFarmer in Zimbabwe (a product line of MNO Econet) and Agrilife in Kenya, Uganda, and Indonesia (led by IT developer Mobipay). While still nascent, they are showing early, although modest, successes. For example, Agrilife's collection of farmer transactions has resulted in an increase of loans to farmer participants. One of the three banks currently using the Agrilife platform, Century Microfinance Bank, lends to individual Agrilife farmers via farmer cooperatives and other aggregators, from whom it obtains a loan guarantee. In August 2013, Century began lending via Agrilife. By December 2013, Century's outstanding loan portfolio had risen from KSH 25.2 million to KSH 88.6 million. Using the Agrilife platform, Century was able to increase its loan portfolio by 250 percent in five months with minimal extra costs.

and the moisture content (to indicate propensity toward rot or disease).[20] A global positioning system device records location at the time of the data input, helping to ensure that those inputting data are not remotely inventing information and that the grain can be tracked down if needed. Based on the data collected and the value of the stored grain at harvest time, Grameen and FCI determine the loan eligibility amount. They share this information with a partner financial institution, which relies on this data to make a final credit decision and disburses an advance to the farmers against the value of their stored crop.

Risks related to storage and side-selling are mitigated in a number of ways: *(i)* farmers guarantee each other's loans, and are also mobilized to check the grain of their fellow farmers throughout the storage period; *(ii)* the village knowledge workers conduct "verification checks" throughout the storage period—these checks are collected via mobile application and measure the moisture content and quantity of grain being stored at the household or group level; and *(iii)* the loans themselves act as a risk mitigant against side-selling, as farmers are less likely to side-sell if they have some cash to weather shocks and if they are able to sell at a higher price at a later date as a result of group bulking and selling.

In addition, the lender's financial exposure is limited: the loans cover only 50 percent of the value of the grain stored, and with estimated price increases

20 In cases where farmers store their crops at their home or on a group level outside the village warehouses, farmers or farmer groups are personally responsible for guaranteeing the crops they are storing. Such farmers need to adhere to minimum storage requirements before their harvest information is entered into the e-Warehouse system. For example, if the moisture content of the maize exceeds 13.5 percent, or if the structures are not protected from rain or rats, they cannot participate.

of about 50 percent, the loan exposure is typically equivalent to only a third of the value of the grain at sale time.

e-Warehouse is still in its very early stages of design. The pilot indicates that while digitization can help connect farmers to finance, there are still challenges. One challenge is finding partner financial institutions that are both comfortable with the inherent risk (particularly around home storage) and willing to commit the required internal resources. Another challenge is time sensitivity—farmers at harvest time are in a hurry to access funds to meet immediate cash flow needs, and the e-Warehouse process takes time. Finally, ensuring accuracy of collected data is a challenge that Grameen and FCI are trying to address through continuous training of the Village Knowledge Workers.

Reducing Risk: Agricultural Insurance in Kenya and Zimbabwe

Crop and livestock insurance reduce the risk in agricultural lending, helping lenders and farmers alike. In Kenya, the Syngenta Foundation for Sustainable Agriculture and UAP Insurance have developed Kilimo Salama (Safe Agriculture), an index-based weather insurance product that allows farmers to insure inputs purchased at participating agricultural dealers. Farmers pay a premium equal to approximately 5 percent of the $100 worth of inputs required to plant one acre of maize, and the input manufacturer matches with another 5 percent. Farmers can register through microfinance institutions, cooperatives, or agricultural dealers, all of whom use a mobile phone application (developed jointly by Syngenta and Safaricom) to enter the farmer's details into the system. The farmer then receives a confirmation SMS listing registration details and a policy number.[21] Rain levels are monitored using satellite data and automated weather stations; in the event of excess rain or drought, funds are automatically paid into the farmer's M-PESA account.

Kilimo Salama has developed a low-cost agricultural insurance product that can be affordable for smallholder farmers by *(i)* outsourcing farmer registration to lenders and agricultural dealers equipped with a mobile application, *(ii)* using remote, index-based monitoring technology that does not require costly in-person verification of claims, and *(iii)* using M-PESA for payouts. Another key to its expansion was moving from an "opt-in" approach (requiring marketing to encourage farmers to make a "grudge buy") to an "opt-out" approach through which farmers are automatically enrolled upon purchasing applicable products. As of the end of 2013, nearly 185,000 smallholder farmers in Kenya (and Rwanda[22]) had obtained Kilimo Salama insurance, of which a vast majority were farmers taking loans from MFIs to buy certified seed and fertilizer, where the insurance was mandatory and bundled into the loan.[23] According to Syngenta, a 2012 impact assessment concluded that insured farmers invested 20 percent more and earned 16 percent more than their uninsured neighbors.

Key challenges that Kilimo Salama faces relate to trust and profitability. Most farmers either have no experience or a bad experience with insurance products. Sensitizing farmers has been a costly, time-consuming process, and most early adopters initially insure only a small amount of seed or other inputs until they are confident that payouts will be made (IFC n.d.). In addition, Kilimo Salama has incurred significant upfront costs for purchasing required hardware and software, obtaining government approvals, and developing partnerships and relationships with agrodealers, farmers, and others. As a result, there are still questions about the viability of the product, at least until it achieves sufficient economies of scale.

MNO Econet is developing a similar insurance product in Zimbabwe. EcoFarmer, a joint venture between Econet's product line EcoFarmer and Cell Insurance, insures 10 kg bags of Seedco EcoFarmer Special Maize Seed, sold at EcoFarmer agents and partners. Farmers first register as EcoFarmers at the agent or partner institution by providing identification information. Farmers then can purchase insurance using an Econet-enabled mobile phone by dialing

21 See http://kilimosalama.files.wordpress.com/2010/02/kilimosalama_v031.pdf.
22 As of early 2014, farmers in Rwanda were not yet using mobile phones to access Kilimo Salama services.
23 While bundling insurance with loans for the purchase of agricultural inputs can facilitate access to insurance, this approach raises concerns about whether consumers clearly understand the costs and benefits of bundled products. For a discussion of bundling in the context of microinsurance, see CGAP, Section 6c (2012).

a USSD code, entering a voucher number, and paying an annual premium of US$10 (or US$2.50, if the farmer wants only reimbursement of the seed purchase price).[24] In the event of excess rain or drought, farmers receive a payout through the mobile channel of 10 times the premium paid.[25] A key obstacle in Zimbabwe to customer uptake is farmer reliance on government pay-outs in the case of crop failure or natural disaster.

Agricultural insurance products aimed at smallholders have recently expanded into coverage of livestock. For example, Juhudi Kilimo, a provider of smallholder agricultural asset financing, has been offering livestock insurance in Kenya since 2009 but recently partnered with Kilimo Salama to enhance the product offering. Farmers who borrow from Juhudi Kilimo to buy a cow can obtain dairy insurance covering up to 80 percent of the cow's value. Borrowers pay a premium of 3.5 percent of the cost of the cow and commit to following a Best Practice Care Calendar, including vaccination, tick control, deworming, and mineral supplementation. If the cow dies within one year, a local veterinarian determines the cause of death and covered farmers are eligible for a payout equal to 50–80 percent of the cow's insured value.[26] The use of the mobile channel can facilitate repayment of farmer loans and insurance payouts, but payouts often exceed mobile wallet limits, requiring the use of cumbersome checks.

4. Conclusion

Although the use of digital financial services to expand smallholder access to finance is still in its infancy, the sheer number of pilots is cause for optimism. DFS are addressing a number of traditional pain points in the context of agricultural finance, making it easier for farmers to save, borrow, manage irregular income, obtain inputs, and insure against loss. And as mobile phone access, network coverage, and digital ecosystems continue to expand, we can expect to see more financial service providers targeting the largely untapped smallholder client base.

The use of DFS to reach smallholders nevertheless faces a number of challenges. One key challenge is that the traditional difficulties of digital finance (such as enrolling customers and developing agent networks) are amplified when it comes to reaching smallholders who not only have generally lower levels of financial capability but who also generally live in rural areas with lower levels of infrastructure and network coverage. While mobile phone use is expanding rapidly, many smallholders still lack SIM cards and/or share handsets with others.

As a result, some countries may be better served through adoption of other technologies, particularly in the short term. A related risk, however, is adopting short-term technological solutions that limit the potential for farmers to use these solutions as a stepping stone toward fuller financial inclusion. This risk is evident in Nigeria, where the initial GES scheme—which offered a mobile phone-based system with no mobile wallet functionality—is being followed by two card-based pilots with very different ambitions with respect to financial inclusion. In contrast, Rwanda and Ghana are embracing mobile wallets that provide access to an array of financial services.[27] Pilot projects with cocoa farmers in Ghana have already demonstrated that smallholder farmers use mobile wallets for P2P transfers, airtime top-up, and even for cash-in, rather than just cashing out immediately. And in Rwanda, the government and banking sector view smallholder mobile wallets as an entry point to full banking access in the future.

Smallholder receptiveness to mobile financial services likely is correlated with the general adoption of such services already operating in the country. In countries such as Nigeria, where less than 1 percent of adults are active mobile money users,[28] farmers have been reluctant to adopt mobile

24 EcoFarmer initially required farmers to register to receive daily SMS messages at a cost of US$1.50 per month, but now provides the informational service for free.

25 Excess rain is defined as six consecutive days with at least 50 mm of rain within the first 50 days of the planting season. Drought is defined as 24 consecutive dry days from planting until harvest.

26 In general, farmers are paid out 50 percent for preventable deaths (such as tick-borne diseases) and 80 percent for accidental deaths (such as Foot-and-Mouth disease). Certain deaths are not covered, including those related to intentional harm, malnutrition, mastitis, and others.

27 In mature DFS markets such as Kenya, mobile wallets are facilitating access to formal savings (mShwari), agricultural credit (Musoni), consumer credit (mShwari), agricultural insurance (Kilimo Salama), and health insurance (Linda Jamii).

28 Based on statistics provided by the Central Bank of Nigeria.

wallets. In the absence of a nationwide mobile money infrastructure, smallholder farmers have little incentive to use mobile money services. Over time, as mobile money services become increasingly ubiquitous, agents will expand their presence in rural areas and farmers will become more familiar with the concept and technology. Farmers have been more receptive in Ghana, where mobile money adoption is increasing rapidly and approximately 8 percent of adults are now active users.[29] And in countries with high mobile money adoption, farmers may be more open to using mobile wallets. Several East African countries offer good prospects, such as Kenya, Tanzania, and Rwanda, where in 2013 active mobile money users comprised 62 percent,[30] 40 percent,[31] and 25 percent[32] of the adult population, respectively.

One emerging lesson is that reaching smallholders with DFS requires significant effort and resources, particularly in the early stages of product rollout. Smallholders typically are risk-averse and less experienced with technology, so sensitization and training are required. Strong multistakeholder partnerships often are critical to success, as demonstrated in Ghana and Kenya. While these services may not be profitable for all stakeholders in the short term, private-sector players must see a viable business case or the services will not move from pilot to national rollout.

The bulk of current DFS innovations tailored to the agricultural context are driven by the interests not of smallholders but of other parties, such as governments seeking to reduce costs of subsidy delivery or commodity buyers seeking to reduce costs and risk associated with cash payments. There are undoubtedly benefits to smallholders, and these innovations should be encouraged, but these services are not designed with the specific needs of smallholders in mind. Going forward, financial inclusion efforts should focus on complementing current DFS innovations with other innovations that are designed around the needs of smallholder families. This will require a greater understanding of the broad array of smallholder financial service needs, including not only those needs related to agricultural production but also those needs related to consumption and managing other sources of income.[33]

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29 Based on statistics provided by the Bank of Ghana.

30 InterMedia Kenya FII Tracker survey (preliminary results from survey conducted from September to October 2013). As these results are preliminary, data have not yet been validated.

31 Based on statistics from the GSM Association: http://www.gsma.com/mobilefordevelopment/wp-content/uploads/2014/03/Tanzania-Mobile-Money-infographic-GSMA-MMU.pdf.

32 Based on statistics provided by the Banque Nacional du Rwanda.

33 For more information, see http://www.cgap.org/blog/series/understanding-demand-smallholder-financing and http://www.cgap.org/blog/series/diaries-tool-understanding-smallholder-families.

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No. 94
June 2014

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The authors of this Focus Note are Jeremiah Grossman and Michael Tarazi. The authors would like to thank the following for their cooperation, time, and energy in helping the authors research this Focus Note: Selorm Adadevoh and Judith Bossman (Tigo Ghana), Sridhar Reddy and Julius Ameku (GADCO Ghana Limited), Kwesi Korboe (ASI Ghana), Stephen Mink, Sheu Salau and Aparajita Goyal (World Bank), Azeez Muyiwa (Nigerian FMARD), Scott Wallace (IFDC Nigeria), Bolaji Akinboro (Cellulant Nigeria), Pankaj Chawla (WACOT Nigeria), Bulus Ogbaji (FADAMA Nigeria), Robert Hale (DFID Nigeria), Martin Drevon and Jeanne di Arc Nyaruyonga (IFDC Rwanda), Lucy Mbabazi (VISA Rwanda), Charles Murekezi and Emmanuel Nyirimana (Rwandan MINAGRI), Espoir Serugo (Urwego Opportunity Bank), Lawson Naibo and Kizito Okute (Bank of Kigali), Flor Owimbera (Rwandan Government Agronomist), Erin Connor (Grameen Foundation), Lee Babcock (independent consultant), Nila Uthayakumar and Laura Johnson (Kilimo Salama), Nat Robinson (Juhudi Kilimo), Pauline Githugu (Century Microfinance Bank), and Lesley Denyes (Mercy Corps). The authors would also like to thank external reviewers of this paper: Michael Hamp and Kathy Zissimopoulos (IFAD), Maria Pagura (World Bank), and members of the GSMA's MMU and mAgri programs.

The suggested citation for this Focus Note is as follows:
Grossman, Jeremiah, and Michael Tarazi. 2014. "Serving Smallholder Farmers: Recent Developments in Digital Finance." Focus Note 94. Washington, D.C.: CGAP, June.

Print ISBN: 978-1-62696-044-2
pdf ISBN: 978-1-62696-045-9
epub ISBN: 978-1-62696-046-6
mobi ISBN: 978-1-62696-047-3