



WORKING PAPER

National Survey and Segmentation of Smallholder Households in Uganda

**Understanding Their Demand for Financial,
Agricultural, and Digital Solutions**

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April 2016

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ACKNOWLEDGMENTS

The authors wish to thank Caldwell Bishop, Mary Ann Fitzgerald, Lucy Mukemi, David Musiime, Denise O'Reilly, and Mamadou Thiam (InterMedia) for their valuable contributions and feedback during the preparation of this paper.

A. INTRODUCTION AND KEY FINDINGS

Introduction

Uganda is a fast-growing nation and economy, showing year-over-year gross domestic product (GDP) growth¹ since 2013 and a sharp recovery from previous GDP declines. The growth comes largely from public and private investment and demand, as well as expansion of agricultural activities,² which is the foundation of Uganda's economy. It contributes 23 percent of the GDP, and over 80 percent of the population is involved in agricultural activities.³ Coffee, one of the largest exports from Uganda, is almost entirely dependent on the smallholder farming sector.⁴

Both the public and private sector in Uganda have also made significant investments in the country's financial infrastructure in recent years. These have benefited the country at large, increasing access and use of more formal financial services to facilitate greater economic stability. Amidst this growth, smallholder farmers have specific, unique, unmet needs that potentially are more complex because of their livelihood. Smallholder farmers face the cost of inputs such as seed, fertilizer and pesticide; bringing their goods to sale along poor road networks; as well as the lack of or prohibitive cost of post-harvest storage facilities for crops. And, they face these challenges within a largely informal, cash-based economy where they find little to no access to credit, savings or payment plans for their needs.

In close collaboration with GIZ, CGAP conducted a nationally representative survey of smallholder households

between August and September 2015. This study sought to comprehensively map the many activities, interests, aspirations, barriers and pressures facing smallholder households. The questionnaire also explored nonagricultural household activities, financial practices and interests, as well as challenges and aspirations.

This report shares the findings, observations and insights from the national survey of smallholder households in Uganda. It begins with an overview of the research approach, core program objectives, research questions, preliminary phases of development, and topics included in the questionnaire. It then profiles smallholder farmers in Uganda, including their household demographics, farmographics, and decision-making, as well as how farmers self-identify and characterize their identity, and what motivates them to do the work they do.

This comprehensive exploration of the lives of smallholder farming households sought to answer the following three questions:

- What does the community of practice need to know or do to support smallholder farmer households build resilient and productive livelihoods?
- How can financial mechanisms respond to the relevant needs and desires of smallholder households?
- What types of market strategies and approaches can cultivate the uptake and use of financial mechanisms?

The report examines how smallholder households in Uganda manage their income and expenses, along with the

1 United Nations Development Programme's index of human development in 2014 ranked Uganda 163 out of 188 countries for per capita GDP. 2015 Human Development Report (<http://hdr.undp.org/en/2015-report>).

2 As reported by African Development Bank Group (<http://www.afdb.org/en/countries/east-africa/uganda/uganda-economic-outlook/>) from African Economic Outlook (<http://www.africaneconomicoutlook.org/en/>).

3 <https://www.cia.gov/library/publications/the-world-factbook/geos/ug.html>.

4 <http://www.new-ag.info/en/country/profile.php?a=2414>.

issues they face that threaten income and often lead to financial instability. It then describes financial inclusion in the smallholder sector, exploring household tools that are essential for financial inclusion, including mobile phones and national identification documents, as well as adoption of financial products, awareness, barriers, and interests. The sections of the paper that follow then outline meaningful segments of the smallholder population in Uganda, mapping out groups of smallholder farmers that matter for fostering greater product adoption, and delving into their demand for various financial mechanisms. A full explanation of the research methodology is included in Annex 1.

This report has three main goals:

1. Build the evidence base for those working in agricultural finance so that assumptions and/or isolated observations pair with known, reliable representative data about the population.
2. Connect readers with the unique realities of smallholder farmers in Uganda that could otherwise be overlooked, oversimplified, or erroneously generalized from other smallholder farmer markets.
3. Catalyze conversations about “what next” for smallholder-farmer-centered strategies, products and approaches that facilitate agricultural, as well as household finance.

The actual survey and full body of research will support a number of financial and agricultural inquiries that arise within communities of practice, for both the near and long term.

Key Findings

Agriculture is the lifeblood of the smallholder household in Uganda. It provides the primary sustenance of the household, gives the household strength,

financially or emotionally, and drives household priorities.

Agriculture is not easy. It is a labor of intensity, risk, uncertainty and challenges, as farmers know from their own experience. It is also a labor of love. Smallholder farmers in Uganda are passionate and committed to agriculture. They take pride in their work, want to continue in it and try to look for opportunities to advance their work. The realities of agriculture may cause a farmer to take pause and consider diversifying, or opt for other, steadier streams of income, if ever they present themselves, but a transition away from agricultural activities is more likely to be driven by need, not a dislike for farming.

Smallholder agriculture in Uganda is also work that is fairly contained to the household itself. These households engage in agriculture relying mostly on their own resources, with limited outside assistance. What little support they do solicit typically comes by way of family and friends, or other members of the community. More formal entities—such as financial institutions, agricultural inputs providers, resellers, buyers, or other entities often a part of an agricultural value chain—play only a small part in the Ugandan smallholder ecosystem.

Important factors

Five fundamental characteristics of smallholder households in Uganda can help the community of practice foster their greater productivity and resiliency.

1. **Common dependence on agriculture:** Agriculture provides the main income stream into the household, and supports nearly all of the household activities. Majorities of families consume what they grow, trade goods for other necessities, and sell their crops for income. One crop can be used in each of these ways,

but households still often fall short of their monthly needs. Most of the households live at or below the poverty line, and many live in extreme poverty. They work hard, have big aspirations and take pride in their accomplishments.

2. **There is promise with a new generation of smallholder farmers:**

The smallholder farming community includes both tenured, seasoned, experienced farmers who have lived through both the pains and abundant yields that come with farming, as well younger, newer farmers who bring with them more modern perspectives, vitality, and an ambitious mindset. Younger farmers are more educated, and some may also consider leaving agriculture if a compelling alternative arises.

3. **The smallholder farming ecosystem lacks financial and agricultural infrastructure:**

Smallholders have limited connectivity to a value chain, or any formal suppliers for their agricultural activities. Involvement with buyers or resellers is often in the context of loose value chains, meaning that the transactions occur without a contract. Farmers also have limited market access due to lack of transportation, and they know these constraints mean they might not get the best market price for their goods.

4. **There is muted knowledge and perceived relevance of formal financial mechanisms.**

Many smallholder farmers operate without using formal financial services such as bank accounts, nonbank financial institutions (NBFIs), or microfinance institutions (MFIs), and most are not even exposed to these institutions. The majority of smallholder farmers have never been in a bank. Mobile money earns a high level of awareness and presents a potential

opportunity if smallholders could see it as a tool that is relevant for them and their livelihood. Smallholders also lack some of the basic tools for digital financial services, such as national identification documents (IDs). A large majority of smallholder farmers have used a mobile phone in the past, so familiarity is relatively high. Formal financial services are not competing against other formal, or even informal, channels. They are competing against a consumer's interest level and perceived relevance in using them.

5. **Risky practices run counter to financially sound desires:**

In practice, smallholder households do not have savings, do not have access to funds in the event of an emergency, and do not have insurance or any other way to mitigate risk. Their aspirations, however, reflect a financially astute, responsible, and even prosperous mindset. They want to save, they want to insure their activities and they want to have more options for mitigating risk. The appetite for financial security has not yet diminished due to lack of access and the other challenging circumstances they face.

Financial mechanisms

Perhaps the most important element of identifying financial mechanisms that respond to the relevant needs and desires of smallholders is understanding what and how smallholder farmers prioritize. They are farmers at heart, and their profession defines them, so their focus is on their farm. Smallholder farmers think about the farm needs and are driven by working toward a sustainable livelihood to provide for their family.

To that end, they have the greatest appetite for financial mechanisms that help them afford agricultural inputs such as

seed and fertilizer. There is also significant desire for products that can help them afford school fees, which is a pervasive issue in Uganda.

Strategies

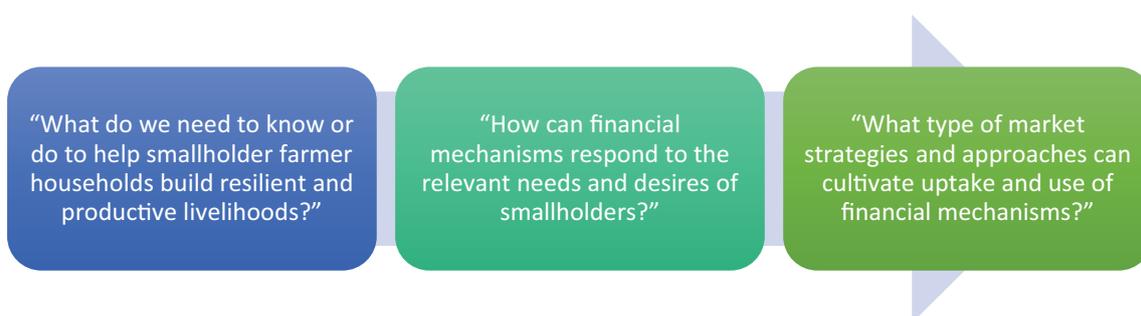
Five strategies emerge to cultivate uptake and use of relevant financial mechanisms:

1. **Equip smallholder households with identification cards and the basic tools needed to become financially included, and educate them about the uses of mobile phones:** Education in digital finance is essential because brick-and-mortar institutions are too distant from home and households lack adequate transportation. Phones should be seen as more than tools for communication; and also perceived as tools for financial transactions or as information channels for important agricultural communications. Individuals within households also need to have national ID cards required to open accounts.
2. **Build on the inherent trust of financial mechanisms:** Smallholder households are keenly aware of mobile money and trust mobile money services about as much as they do banks and other nonbank financial institutions. The majority of smallholders, however, have not been inside a bank and may not even be connected to an informal lending or savings circle. Financial services providers looking to speak to this group should capitalize on the basic levels of trust that smallholder farmers have in these institutions to build a meaningful value proposition.
3. **Empathize with life desires and circumstances:** Most smallholder farmers do not want to leave agriculture. Instead they want to take what they do, and do it better. They want to move away from risky financial practices and behaviors, and then find a way to build greater economic stability. Many feel they are barred from mechanisms that can help them do just that. They feel they do not have the right type of identification, a mobile phone, enough money to open an account, and sometimes, smallholder farmers are simply not aware how these mechanisms are relevant to them. Empathizing with their struggles and appealing to what smallholder farmers ultimately want for their lives can potentially break down intangible (as well as tangible) barriers to product adoption.
4. **Pair immediate needs with long-term desires:** The survey tested potential dual-mode products that combined both short- and long-term benefits to farmers. Loans that include insurance, loans that include banking or savings accounts, mobile money accounts that include savings and similar bundled products can go a long way in appealing to immediate needs and conditioning a desirable long-term practice. Further, farmers do not want to see their hard labor squandered due to bad weather or pests, and therefore, want access to insurance or even convenient and reliable information to mitigate those risks.
5. **Think “economies of scale”:** Just under half of smallholder farmers can be characterized as “farming for sustenance.” The economic value for investors and providers is found in both the size of this population and the lack of competition for its attention.

B. ABOUT THE PROJECT

Working to build the evidence base on smallholder farming households, GIZ and CGAP sought to explore in more detail the financial and agricultural lives of smallholder households in Uganda. This research project began

with a comprehensive attitudinal and behavioral research program in January 2015. It consisted of a survey with an accompanying household listing and a segmentation. The research sought to answer three key questions.



Existing Research and Stakeholder Discussions. Building on other household surveys in sub-Saharan Africa (e.g., agricultural censuses, Living Standards Measurement Study, FinScope, AgFiMS), as well as the 2013 CGAP global segmentation,⁵ this methodology and survey instrument were designed to answer a number of questions about smallholder households in Uganda:⁶

- **Understanding and segmenting smallholder households.** What are the key characteristics of the smallholder sector at the national level (e.g., demographics, poverty status, hectares, crops and livestock, level of intensification, market relationships)? What segments of smallholder households emerge?
- **Attitudes and perceptions of smallholder households.** How do smallholder households perceive their agricultural activities (i.e., is it seen as a subsistence activity

or a business?), and do household members, especially youth, see a future in farming? On the financial side, what is the level of comfort with digital financial services and other channels and service providers?

- **Opportunities to improve financial inclusion for each segment of smallholder households.** What financial mechanisms does each segment of smallholder households demand, both in terms of customer needs (crop storage, transfer, build, secure, etc.) and products (e.g., credit, deposit, insurance)? What informal and formal suite of financial mechanisms does each segment currently use and where are opportunities to add value with new services and/or delivery channels?

The first months of the project included a series of deep dives into the existing research in the smallholder space to determine what questions had already been asked, identify their findings, and

5 See Christen, Robert Peck, and Jamie Anderson. 2013. "Segmentation of Smallholder Households: Meeting the Range of Financial Needs in Agricultural Families." Focus Note 85. Washington, D.C.: CGAP, April.

6 CGAP retained the services of InterMedia to manage the survey in partnership with Ipsos Uganda. Additional national surveys and segmentations of the smallholder sector, led by CGAP, are also underway in Tanzania, Côte d'Ivoire, and Bangladesh. A national survey and segmentation of smallholders in Mozambique was released in March 2016.

determine how to drive our objectives to complement and expand on them. The research team consulted several sources in the process of building the program, including IFC, Dalberg, Finmark Trust, FAO, GIZ, IFAD, and the World Bank. The secondary research brought a series of questions that informed discussions with stakeholders.

GIZ has been a close partner for this research with smallholder households because of its central role in advancing financial inclusion in Uganda, particularly among rural and agricultural households. This coordination was important to inform the CGAP research, and its results will contribute to GIZ's market research and strategy. Several additional stakeholders and organizations also contributed valuable insights and considerations into the design of the research project as key informants, and took part in an informal technical working group to review and guide the research. Some of these key organizations included African Development Bank, TechnoServe, FINCA Uganda, Grameen Foundation, Uganda Coffee Farmers Alliance, Opportunity International, Uganda Coffee Development Authority, KfW, Mercy Corps, the Bill & Melinda Gates Foundation, as

well as World Bank Group colleagues, including the Living Standards Measurement Survey (LSMS) team.

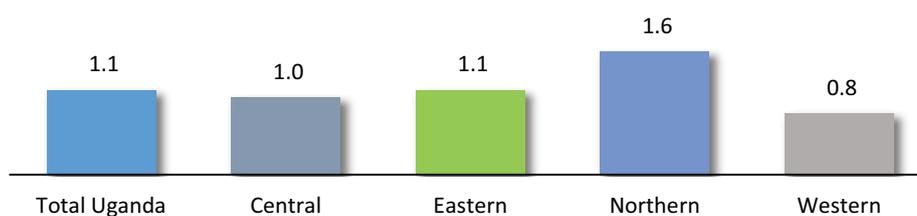
The extensive secondary research and discussions with stakeholders identified a gap in information about the actual needs, desires and perceptions of smallholder households. There seemed to be significant amounts of data and insights about smallholder households in Uganda that focused on either their agricultural activities or their financial lives, but nothing to date had taken a more comprehensive view of the household. This research project also sought to connect the agricultural data to the financial data to examine the interactions between the two.

Identifying Target Group of Smallholder Households. Discussions with consultants and stakeholders in sub-Saharan Africa and extensive desk research⁷ concluded there is no clear agreement on the characteristics that define a smallholder, due in part to the heterogeneity of this client group. As a result of both of these lines of investigation, a matrix was developed for each of the key criteria that could be used to distinguish smallholder households from other households (see Table 1).

TABLE 1. Key criteria in defining smallholder households

Key Criteria	Considerations
Market orientation	Subsistence vs. market-oriented vs. hybrid
Landholding size	Threshold
Labor input	Family vs. hired
Income	Shared income from farming, multiple sources
Farming system	Technology, irrigation
Farm management responsibility	Owner, influence over how to farm
Capacity	Storage, management, administration
Legal aspects	Formal vs. informal
Level of organization	Member of group—producer, supply chain, service provider

⁷ Defining Smallholders: Suggestions for a RSB smallholder definitions; Roundtable on Sustainable Biomaterials; October 2013.

FIGURE 1. Average size of agricultural holdings (in hectares) in Uganda

The desk research also found a range of definitions of a smallholder household across countries, reflecting the variations in their agricultural sectors. Some governments define smallholders solely by their landholding size. The range differed greatly across Asian and African countries—from a maximum of 2.5 hectares in India up to a maximum 46 hectares in Malaysia. In Uganda, research from the Uganda Bureau of Statistics Census of Agriculture pointed to smaller average farm sizes, which further reinforced the justification of our target group. In Uganda, the average farm size ranged between 0.8 and 1.6 hectares, depending on the region of the country (Figure 1).⁸

The research team established a high watermark to identify smallholder

households in a way that was as inclusive as possible, without diluting or distorting the population representation. The identification measure used two key criteria—landholding size and livestock count—as the starting point for identifying the target group for sample selection. A series of self-identifying perception questions was also asked to ensure that each smallholder household selected for the study viewed agriculture as a meaningful part of the household's livelihood, income and/or consumption.

Before the survey, a household listing exercise was conducted to identify potential households to include in the survey sample. The listing exercise targeted smallholder households with the following criteria:

FIGURE 2. Listing criteria to identify relevant smallholder households

Household with up to 5 hectares OR Farmers who have less than: 50 heads of cattle; or 100 goats/sheep/pigs; or 1,000 chickens	AND	Agriculture provides a meaningful contribution to the household livelihood, income, or consumption (self-identified)
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Listing Operation and Methodology.

CGAP's global implementation partner for the national surveys of smallholder households, InterMedia, worked very closely with the Uganda Bureau of Statistics to conduct a household listing operation in randomly selected enumeration areas from 15 July to 7 August 2015

to construct a reliable sampling frame. The listing operation was implemented by Ipsos Uganda, InterMedia's local field partner in Uganda.

Then, using a stratified, multi-stage sample,⁹ each region was classified into urban and rural areas based on the 2014

⁸ Census of Agriculture; Uganda Bureau of Statistics, Ministry of Agriculture, Animal Industry and Fisheries, 2008/2009.

⁹ The methodology and design are detailed in Annex 1.

TABLE 2. Framework for the smallholder questionnaire

Section	Demographics	Household economics	Agricultural practices	Mobile phones	Financial services
Examples of topics covered	Relationship	Income	Land ownership	Use (own or borrow)	Formal institutions
	Marital status	Jobs	Crops grown	Types of phones	Less than formal institutions
	Age	Government payments	Livestock	Barriers	Informal financial service providers
	School attendance	Saving	Value chain	Habits	Importance
	Income	Investing	Market relationship	Products	Borrowing
	Decision-making	Emergency planning	Water		Products
	Financial situation	Risk mitigation	Labor		
	Progress out of Poverty Index (PPI)		Inputs		
			Storage		
			Coping		

population census, and the sample was selected independently in each urban and rural stratum. The 216 (EAs) were randomly selected as primary sampling units with probability proportional to the number of households in the EAs, and then 15 smallholder households were selected in each EA with equal probability, which yielded a total of 3,240 smallholder households in the sample.

Questionnaire Design. The questionnaire design process began by using the secondary research and stakeholder discussions as core inputs into the measurements to shape the survey instrument. This process also involved defining the end goal of the research by doing the following:

- Drawing from existing survey instruments.

- Considering the objectives and needs of the project.
- Accounting for stakeholder interests and feedback.

These foundations led to a framework for the survey instrument for sharing across stakeholders, and to ensure the research captured all of the necessary elements of a smallholder household. The framework was built around the sections shown in Table 2.

Organization of the Survey. The questionnaire was divided into three parts to capture the complexity inside smallholder households, with certain questions asked of all relevant individuals in the household, not just one household member (Table 3).¹⁰ It was designed in this way to capture the complete

¹⁰ The three questionnaires can be found in the user guide that accompanies the data set for this research.

TABLE 3. Design of smallholder questionnaires

	Household survey questionnaire	Multiple-respondent survey questionnaire	Single-respondent survey questionnaire
Target respondent(s)	Head of the household, spouse, or a knowledgeable adult	All household members over 15 years old who contributed to the household income or participated in its agricultural activities	One randomly selected adult in the household
Topics covered	<ul style="list-style-type: none"> • Basic information on all household members • Information about household assets and dwelling characteristics 	<ul style="list-style-type: none"> • Demographics • Agricultural activities • Household economics 	<ul style="list-style-type: none"> • Agricultural activities • Household economics • Mobile phones • Formal and informal financial tools

portrait of the smallholder household, as some members of a household may work on other agricultural activities independently, without the full comprehension of their involvement and responsibilities by members of the household.

The questionnaire was translated into nine languages—Acholi, Ateso, Langi, Luganda, Lugbara, Lugishu, Lutooro, Ngakaaramojong, and Runyankole—and then pretested and validated in all nine

languages to ensure the integrity and appropriateness of the questions were in line with social and cultural customs.

Data collection took place from 16 August to 7 September 2015, using computer-assisted data collection tools that regularly yielded data for analysis and quality control to provide timely feedback to field staff. The Uganda smallholder household survey was implemented by Ipsos Uganda, InterMedia's local field partner.

C. FINDINGS¹¹

1. SMALLHOLDER HOUSEHOLD DYNAMICS IN UGANDA: WHO THEY ARE

Smallholder farmer households are typically headed by men who have low levels of education yet maintain an optimistic viewpoint on their future.

Smallholder households span Uganda, with the greatest density concentrated in the Western and Eastern regions of the country. Less than one-quarter (23 percent) are concentrated in the Northern region, where national statistics show the highest poverty levels,¹² leaving the smallest population of smallholder farmers in the Central region (16 percent) (Figure 3), which is the most economically thriving part of the country.¹³

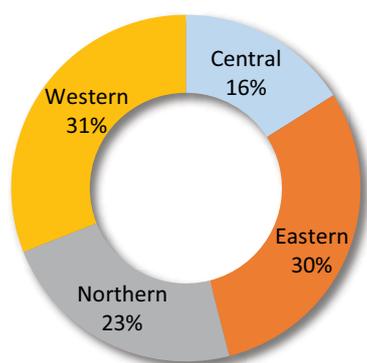
A man is three times as likely to be the head of a smallholder farming household as is a woman (77 percent men vs. 23 percent women) (Figure 4). While households are male-dominated, women do play an important, if not critical,

decision-making role when it comes to the agricultural activities of the household.

There is both maturity and youth in the Ugandan smallholder population. Nearly half of heads of households are under the age of 40 (45 percent). A significant portion, approximately one-fifth, is under the age of 30 (Figure 5). Just over half (55 percent) are 40 or older, and one in five is at the far end of the age spectrum (60+ years old).

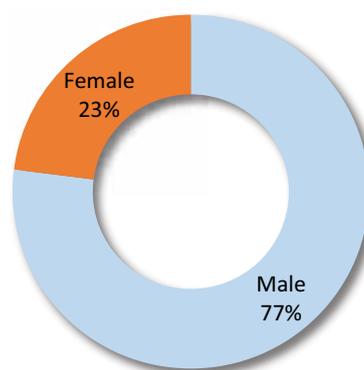
Smallholder heads of households typically manage their households, families and livelihoods with limited formal education, rarely surpassing primary school (Figure 6). One-fifth have no formal education, and 64 percent did not continue their education past primary school. Only 16 percent advanced through secondary school. There is a sharp gender difference in education levels (Figure 7). Female household heads are even more

FIGURE 3. Region



Sample: Smallholder households, n=2,870

FIGURE 4. Gender of head of household



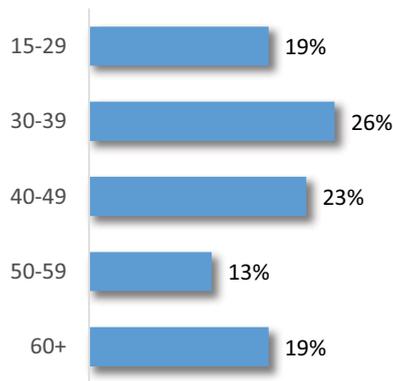
Sample: Smallholder households, n=2,870

¹¹ Graphs and tables in the main body of the report include references to the unweighted base size, and, therefore, at times, will not look proportional to graphs that show subsets of other graphs. Due to rounding, not all percentages in charts total 100.

¹² As reported by The African Development Bank (<http://www.afdb.org/en/countries/east-africa/uganda/uganda-economic-outlook/>) from African Economic Outlook (<http://www.africaneconomicoutlook.org/en/>).

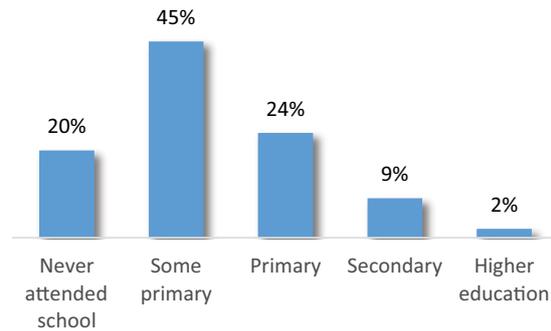
¹³ Ibid.

FIGURE 5. Age of head of household



Sample: Smallholder households, n=2,870

FIGURE 6. Highest education attained by head of household



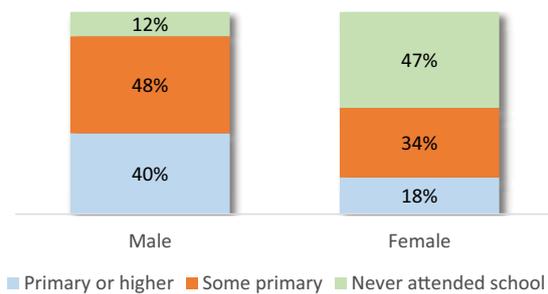
Sample: Smallholder households, n=2,870

likely to have no formal education (47 percent, vs. 12 percent of men, have never attended school).

Three-quarters of smallholder household heads are married or cohabiting, and about one-fifth are divorced, separated, or widowed (Figure 8). The gender of the head of household differs by marital status; men lead single/never married and married homes while women lead divorced/separated/widowed homes (Figure 9).

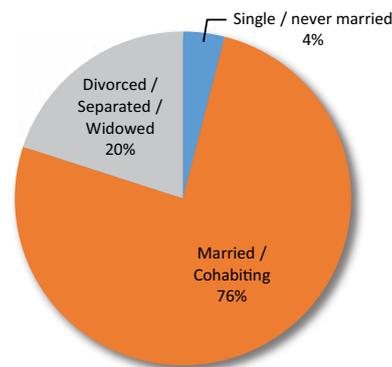
The smallholder household size and composition can vary across the population, including some very small households of just one person (6 percent), as well as those with eight or more people (18 percent).¹⁴ Seven percent of smallholder households have 10 or more members (Figure 10). The median household size is five, and the presence of households with double that number may point to the general fluidity of circumstances and family life, and the importance of risk mitigation. This fluidity

FIGURE 7. Highest education attained by gender of head of household



Sample: Smallholder households, n=2,870

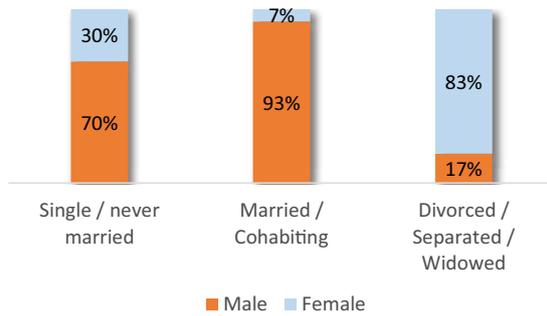
FIGURE 8. Marital status of head of household



Sample: Smallholder households, n=2,870

¹⁴ For the purposes of this survey, “household” was defined as a group of related or unrelated persons who live together in the same dwelling unit, eat together from the same pot, and share most household expenses. Visiting relatives and domestic workers are not considered members of a household and will, therefore, not be included in this study. The listing manual in the user guide seems to contradict this: “Note, however, that domestic servants and other workers living and eating in the same household should be included as household members.”

FIGURE 9. Marital status by gender of head of household

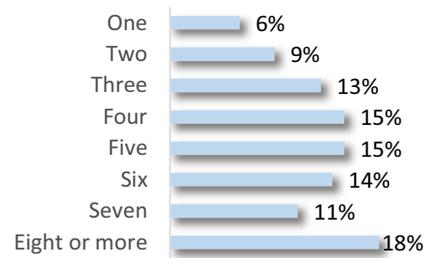


Sample: Smallholder households, n=2,870

could be positive (e.g., a new breadwinner arrives to contribute to the household), but also a challenge (e.g., the very young and very old who need special care and are not in a position to contribute much to the household).

A large household size is also significant because many households fall below the poverty line of US\$2.50 a day¹⁵ (Figure 11). Using the lower PPI score of US\$1.25 a day, the comparison is even starker: roughly one-quarter of all smallholder households live on less than that amount per day (Figure 12). Smallholder farming households live without much of a cushion to absorb additional expenses. Roughly two-fifths of all smallholder households typically do not have enough money for food for

FIGURE 10. Number of people in household

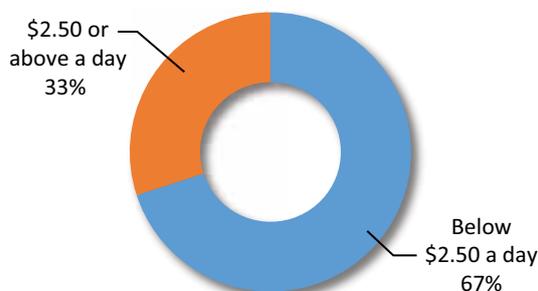


Sample: Smallholder households, n=2,870

their households, and another two-fifths have money only for food and clothes (Figure 13).

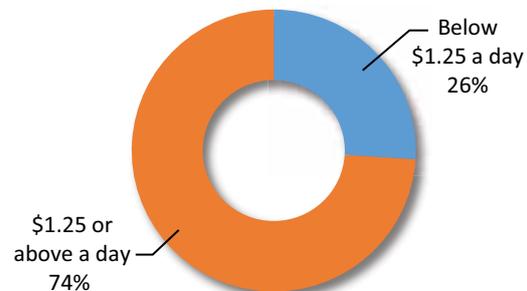
Smallholder farmers' outlook on life and their agricultural work is in stark contrast to their households' circumstances. Despite limited means and economic vulnerability, most take the position that they work hard to be among the best at what they do (93 percent), their actions determine their lives (86 percent), and their successes are due to hard work (84 percent). They also align with the perspective, "I always look for opportunities for improving my situation," suggesting a proactive rather than a reactive approach to their lives (Figure 14). Far fewer farming households take a more passive approach, believing it is

FIGURE 11. Poverty status of household



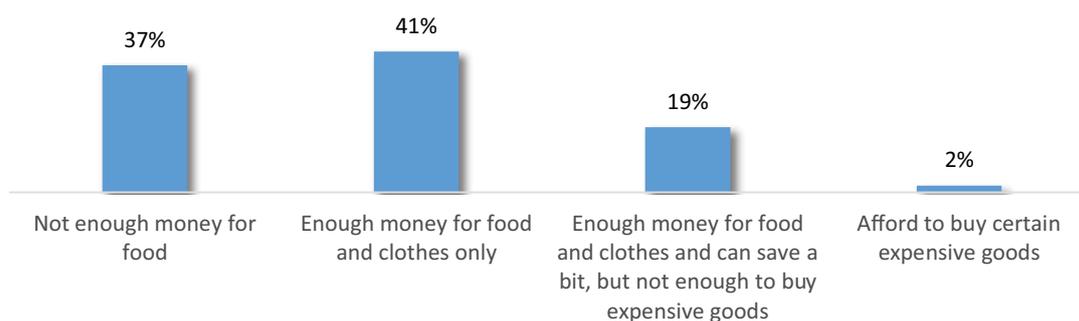
Sample: Smallholder households, n=2,870

FIGURE 12. Poverty status of household



Sample: Smallholder households, n=2,870

15 From Progress out of Poverty Index 2013, Grameen Foundation; <http://www.progressoutofpoverty.org/>.

FIGURE 13. Household's current financial situation (self-assessed)

Sample: Smallholder households, n=2,870

not wise to plan too far ahead because one's luck might factor more heavily into the future than planning (50 percent).

Farm as source of income and subsistence

Typically, Ugandan smallholder farmers individually own their plots of land, either through a lease or certificate, or under customary law. Roughly two-fifths of these farms fall under customary law (Table 4), which means there is usually no official documentation of ownership. State and communally owned farms are in the minority, and mostly concentrated in the Northern region.

Land tends to be in small plots;¹⁶ roughly two-thirds of Ugandan smallholder households own less than two hectares (app. 2.5 acres) of land (Figure 15). Another one-sixth of the households have between two and five hectares.

Smallholders in Uganda primarily grow food and staple crops, and there is a collection of commonly grown crops. Maize and beans are the most common, followed by cassava, sweet potatoes and groundnuts (Figure 16). Only small percentages grow cash crops, which tend to be coffee and sugar cane (Figure 17). The median number of crops per household is seven, and just

FIGURE 14. Do you agree or disagree with the following statements?

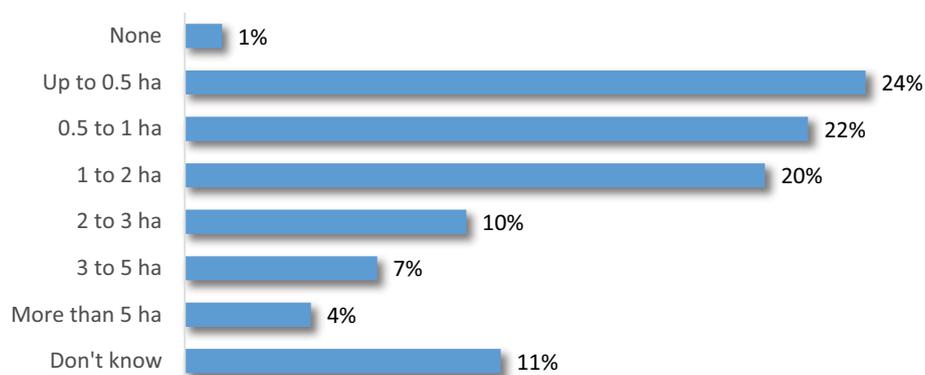
Sample: Smallholder farmers, n=2,771

16 Land size is a difficult thing to measure accurately. Many recent examinations of land measurement say that using farmer estimates of land size usually lead to errors. Carletto, Gourlay, Winters. World Bank. "From Guesstimates to GPSstimates," July 2013. http://www-wds.worldbank.org/external/default/WDSContentServer/WDSP/IB/2013/07/30/000158349_20130730084245/Rendered/PDF/WPS6550.pdf.

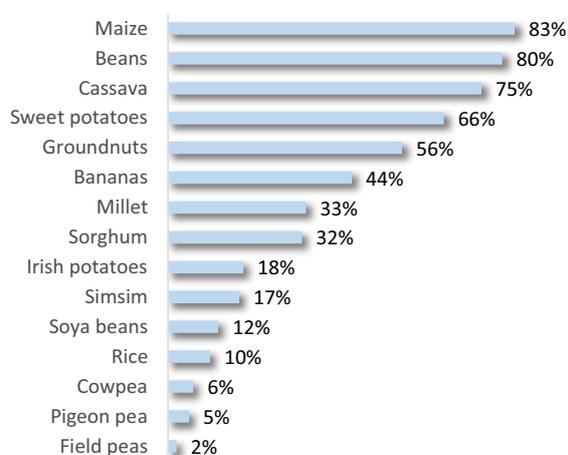
TABLE 4. What is the form of ownership of your land?

	Total	Central	Eastern	Northern	Western
Individual ownership with lease or certificate	31%	47%	28%	19%	37%
Individual ownership under customary law	40%	24%	41%	52%	37%
Communal (resources are shared)	8%	6%	5%	20%	4%
State ownership	0%	1%	0%	0%	1%
Other	10%	7%	11%	7%	11%
Don't know	10%	15%	14%	2%	11%

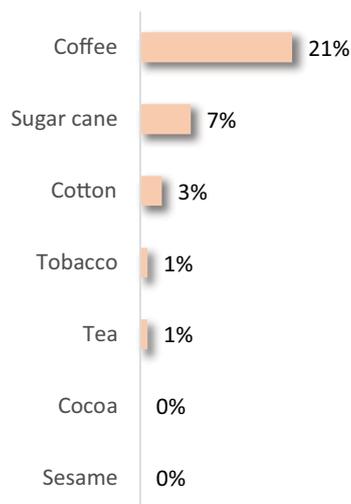
Sample: Smallholder farmers who participate in agricultural activities, n=5,203

FIGURE 15. How many hectares (ha) of agricultural land do you own?

Sample: Smallholder households reported land size, n=2,765

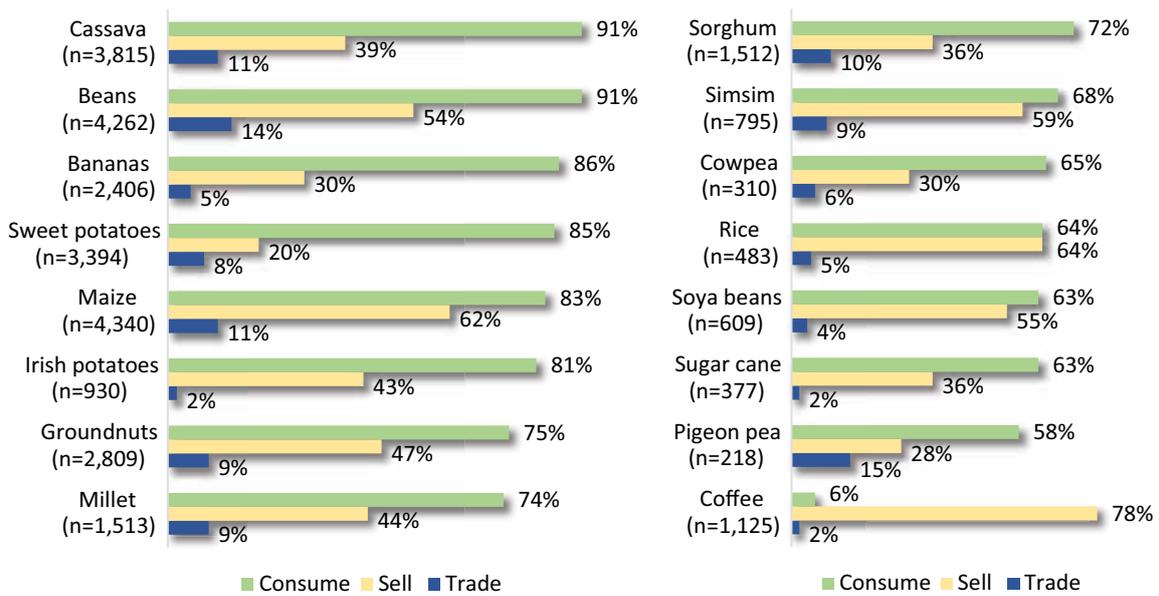
FIGURE 16. Which of the following crops do you grow? Food and Staple Crops

Sample: Smallholder farmers who participate in agricultural activities, n=5,203

FIGURE 17. Which of the following crops do you grow? Cash Crops

Sample: Smallholder farmers who participate in agricultural activities, n=5,203

FIGURE 18. Crop type by percentage of consumption, sale, or trade



Sample: Smallholder farmers, n=5,203
Multiple responses allowed
(% of people who grow each crop)

over one-quarter (27 percent) grow more than eight crops.

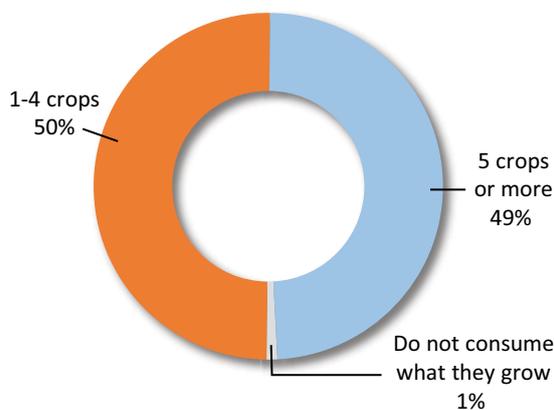
Households use their crops in multiple ways, including for their own consumption. Consumption rates the highest of the three main uses (consume, sell, or trade), particularly in the case of most food or staple crops, and even for some cash crops (Figure 18). An estimated nine out of 10 smallholder farmer

households consume at least a portion of their crops.

A single crop itself can also serve multiple purposes. For example, 91 percent of cassava farmers say they consume it, just under two-fifths sell it and approximately one-tenth trade it.

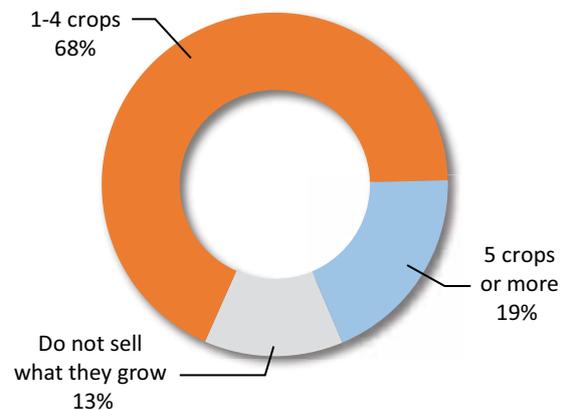
CGAP’s National Survey and Segmentation of Smallholder Households in

FIGURE 19. Number of crops grown for consumption

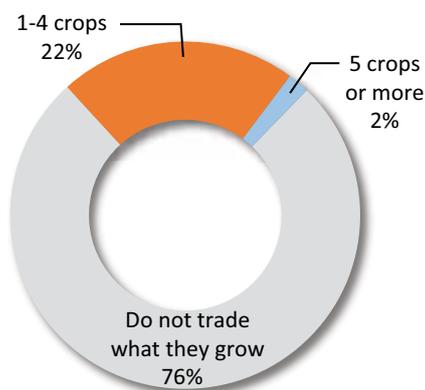


Sample: Smallholder farmers who grow crops, n=5,088

FIGURE 20. Number of crops grown for selling



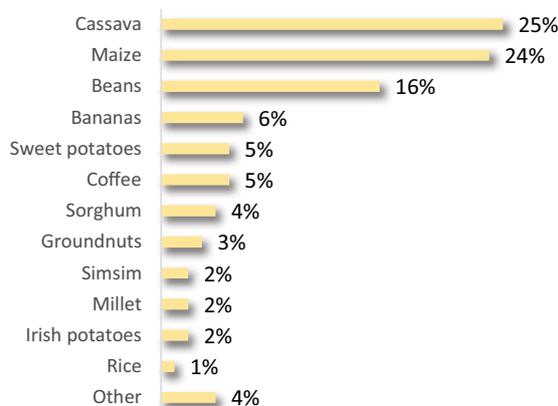
Sample: Smallholder farmers who grow crops, n=5,088

FIGURE 21. Number of crops grown for trading

Sample: Smallholder farmers who grow crops, n=5,088

Mozambique¹⁷ also explored crop growth and use. In Mozambique, there tend to be just a few select crops that are of utmost importance to the country's smallholder farmers. Most Mozambican smallholder households grow maize (88 percent) and the next most common crop is a distant second, cassava (55 percent), followed by beans (47 percent). Maize is considered the most important crop (66 percent) among its growers; no other crop comes close to the importance of maize. Only 10 percent of cassava growers consider it their most important crop, coming in second to maize.

Uganda shows a different dynamic, with much more crop diversity. Uganda has several crops that are important to smallholders. The vast majority of smallholder farmers in Uganda grow cassava, maize and beans; the most important to them and their families is a split between cassava and maize (Figure 22). Cassava and maize also play an important role in household consumption. Maize, beans, cassava and coffee also register as important crops for sale (Table 5) among a smaller, more niche group of farmers. There are several crops that

FIGURE 22. Which of the following crops that you grow is the most important to you and your family?

Sample: Smallholder farmers participating in agriculture who grow at least one crop, n=5,088

hold a greater utility for selling than they do for consumption, suggesting there is some monetization that farmers factor in when planning their land use.

Three-fifths of smallholder farmers raise livestock of any kind (Figure 23), and those who raise livestock do so for both consumption and sale. Indigenous chickens (layers) are the most common form of livestock, followed by indigenous goats, goats raised for meat, broilers (indigenous chickens) and indigenous cattle (Figure 24).

The majority of those who rear indigenous chicken do so for consumption (Table 6); a similar dynamic is present for nonindigenous chickens. Cattle, pigs, indigenous pigs and indigenous cattle, however, are reared mostly for income, not consumption, purposes by smallholder farmers.

Women have a significant role in decision-making

Men head over three-quarters of smallholder farmer households (Figure 4), yet decision-making on agricultural

17 <http://www.cgap.org/publications/national-survey-segmentation-smallholder-households-mozambique>

TABLE 5. Which of the following crops that you grow do you consume the most/get the most money from selling?

	Consumption (n=5,058)*	Selling (n=4,374)
Cassava	33%	8%
Maize	19%	24%
Beans	16%	13%
Bananas	10%	3%
Sweet potatoes	8%	2%
Sorghum	4%	2%
Millet	2%	4%
Irish potatoes	2%	2%
Groundnuts	1%	8%
Simsim	1%	7%
Coffee	<1%	11%
Rice	<1%	4%
Soya beans	<1%	2%
Other	1%	10%

*Responses add up to less than 100 percent due to rounding

Sample: Smallholder farmers, n=5,517

(% of smallholder farmers participating in agriculture who grow and consume/sell at least one crop)

activities is not as gendered. In fact, women's roles as decision-makers are important within smallholder households. In some cases, the largest share of agricultural decisions are jointly made by men and women (Figure 25), including when households are headed by men. When they are not joint decisions, in some cases men are slightly more likely

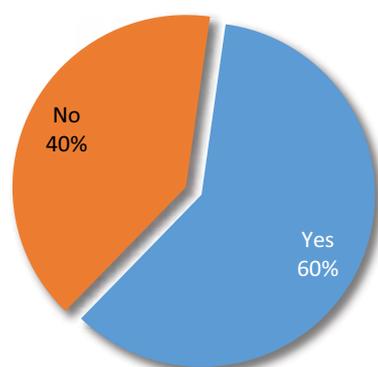
to make the decision solely, without the other.

Dedicated to agriculture and looking to expand their activities

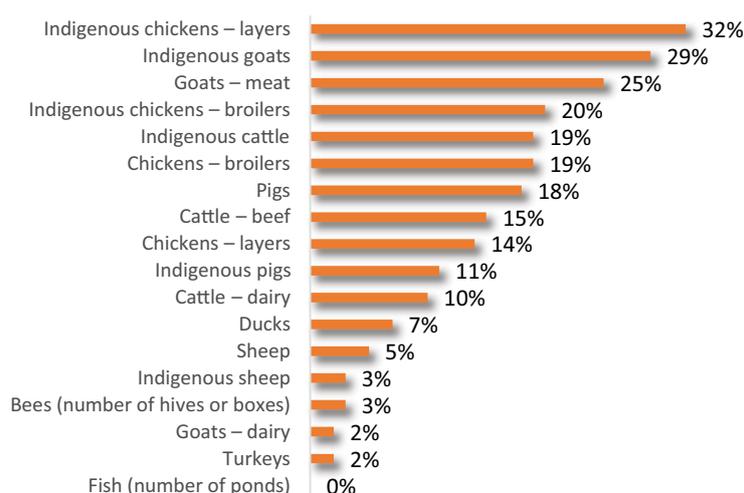
Smallholder farmer households include both tenured and newcomer farmers, reflecting both experienced farmers as well as novices in the sector. Close to three-fifths (58 percent) have farmed for more than 10 years. As many (41 percent) range in experience from very new (less than two years, 5 percent) to moderately experienced (six to 10 years, 19 percent) (Figure 26).

It is mostly the youngest generation (below 29 years old) that is newer to farming, versus individuals adopting farming as a livelihood late in life (Figure 27).

Consistent across households, farming emerges as a life choice and part of an identity, which can offer some insights

FIGURE 23. Do you have any livestock, herds, other farm animals, or poultry?

Sample: Smallholder farmers who participate in agricultural activities, n=5,203

FIGURE 24. Which of the following do you rear?

Sample: Smallholder farmers who have any livestock, herds, other farm animals or poultry, n=3,184
Multiple responses allowed

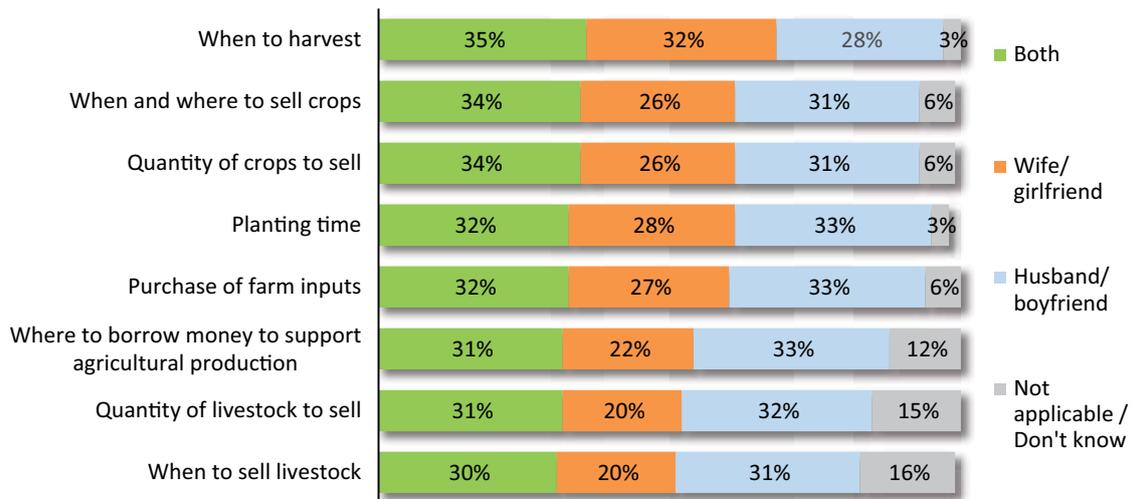
TABLE 6. How many of each of the following do you. . . ?

	Rear and get an income from*	Rear for consumption*
Pigs	79%	23%
Indigenous pigs	76%	14%
Cattle—dairy	71%	44%
Goats—meat	70%	31%
Indigenous goats	68%	29%
Indigenous chickens—layers	59%	78%
Indigenous chickens—broilers	59%	67%
Indigenous cattle	59%	32%
Cattle—beef	59%	30%
Chickens—broilers	58%	74%
Chickens—layers	54%	76%
Sheep	54%	20%
Indigenous sheep	53%	13%
Bees (number of hives or boxes)	51%	50%
Turkeys	50%	34%
Goats—dairy	49%	16%
Ducks	46%	61%
Fish (number of ponds)	17%	17%

*Percentages show incidence within those rearing that specific type of livestock who are getting an income and total who are rearing for consumption. This captures overlap between the two categories.

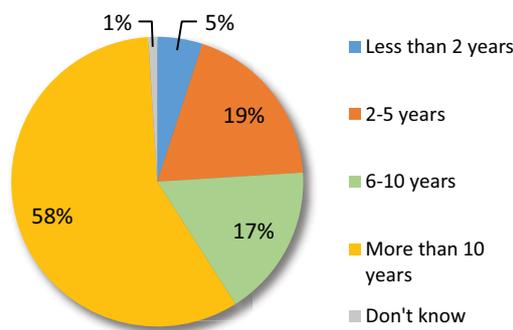
Sample: Smallholder farmers who have any livestock, herds, other farm animals or poultry, n=3,184
Multiple responses allowed

FIGURE 25. Generally, who makes decisions on the following agricultural activities?



Sample: Smallholder households, n=2,870

FIGURE 26. How many years have you been farming?

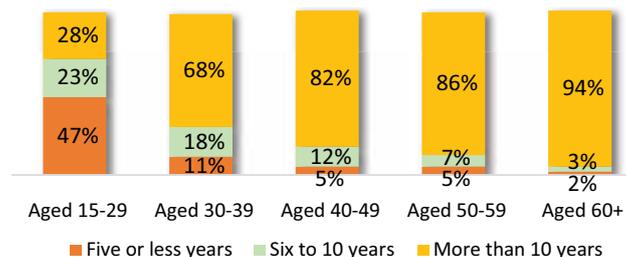


Sample: Smallholder farmers who participate in household's agricultural activities, n=2,296

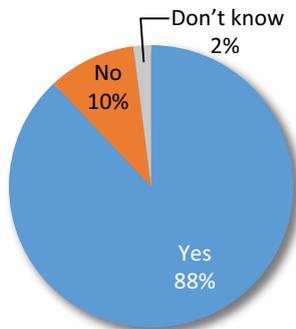
into the motivations of this population, despite their dire financial state. Eighty-eight percent intend to keep working in agriculture (Figure 28). This intent carries across farming tenure and both genders. In fact, roughly seven in 10 of the newest smallholder farmers (farming less than two years) believe they will continue farming as well (Figure 29). Their dedication to agriculture is high, even despite their financial situation (Figure 30), as nearly nine-tenths of those who self-report that they “don’t have enough money for food” want to continue working in agriculture.

Agriculture is not only what feeds the household, it is a livelihood that farmers enjoy. Nearly all agree with the statement, “I enjoy agriculture,”

FIGURE 27. How many years have you been farming? By age of respondent



Sample: Smallholder farmers, n=2,296
(% of smallholder farmers who participate in household's agricultural activities and in each age category)

FIGURE 28. Do you intend to keep working in agriculture?

Sample: Smallholder farmers who participate in household's agricultural activities, n=2,296

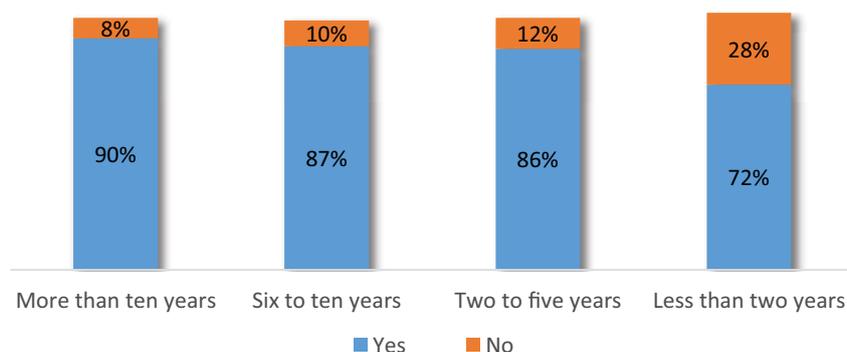
(90 percent), a large majority of smallholders want to expand their work (86 percent), and many (59 percent) are satisfied with what they have achieved (Figure 31). Farmers are fairly united on what they view as their legacies and their desires for the next generation. Just over two-thirds (68 percent) think of agriculture as the legacy they leave their children and a similar proportion want their children to continue in agriculture (66 percent). Agriculture is hard work, and smallholders know the realities. Just over a quarter of farmers are not in agreement with their children continuing in the family business, and others simply are not sure what will be right for their children's future (Figure 31).

Farming realities introduce a three-way clash: dedication, commitment faces off against risk and dire financials, as well as some willingness to alter one's livelihood

Commitment to agriculture, the enjoyment it brings, and the desire to expand are met with conflicting thoughts. Two-thirds would take full-time employment if offered (66 percent), further illustrating just how hard it is to earn income through agriculture, as well as just how opportunistic a farmer has to be to support their family and homestead (Figure 31).

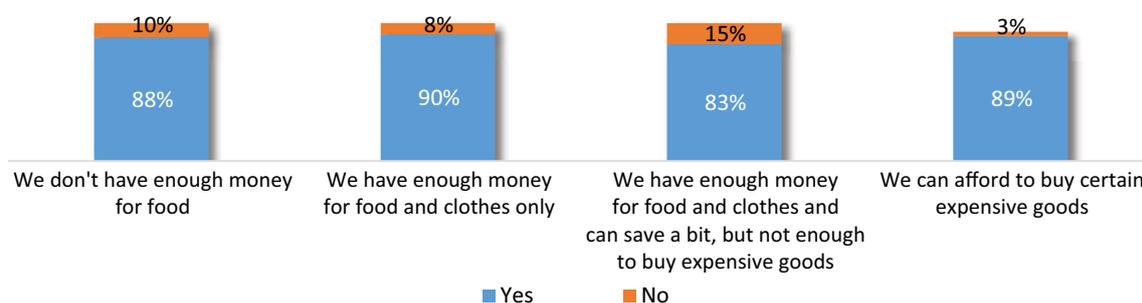
The younger generation of farmers (aged 15–29) shares those same sentiments. Just over three-quarters would take full-time employment if offered it (Figure 32), and just over four in 10 feel they would not want to do any other type of work. Those that are 30 years or older do not feel as strongly about taking full-time employment, as only three-fifths say they would do so (Figure 33).

This conflict between committing to agriculture and the willingness to take full-time employment is real. Farming is hard work, it can be risky, and it still can leave the family in need. That said, deeper analysis shows the conflict might

FIGURE 29. Do you intend to keep working in agriculture? By number of years in farming

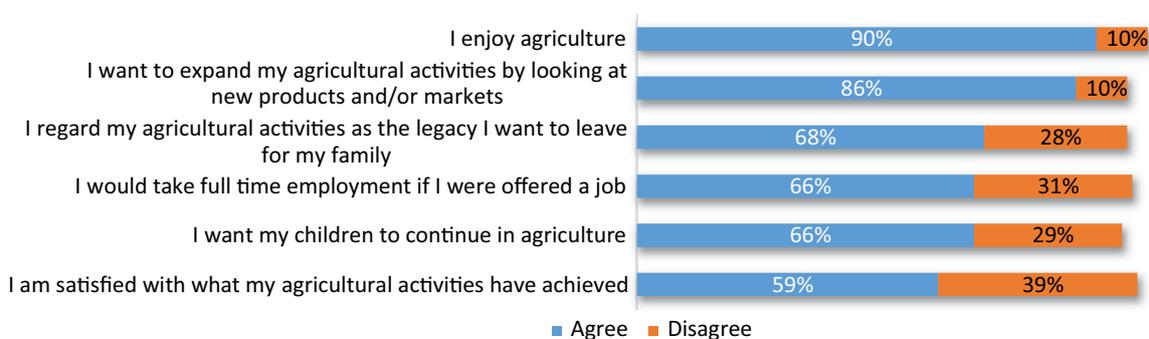
Sample: Smallholder farmers who participate in household's agricultural activities, n=2,296

FIGURE 30. Do you intend to keep working in agriculture? By household's current financial situation (self-assessed)



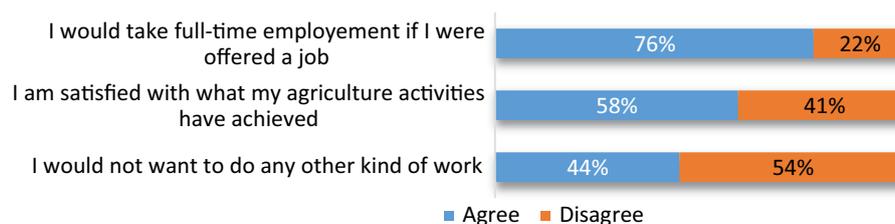
Sample: Smallholder farmers who participate in household's agricultural activities, n=2,296

FIGURE 31. Do you agree or disagree with the following statements?



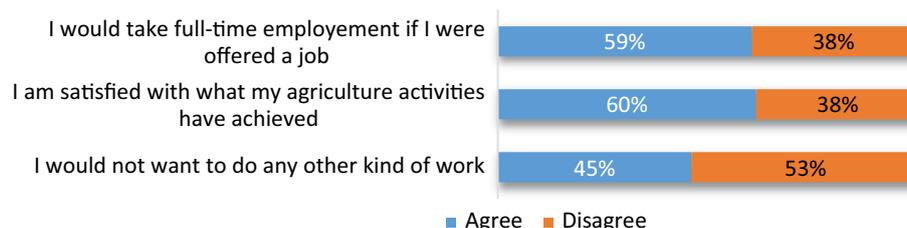
Sample: Smallholder farmers who participate in household's agricultural activities, n=2,296

FIGURE 32. Do you agree or disagree with the following statements?



Sample: Smallholder farmers aged 15-29 who participate in household's agricultural activities, n=860

FIGURE 33. Do you agree or disagree with the following statements?



Sample: Smallholder farmers aged 30+ who participate in household's agricultural activities, n=1,436

TABLE 7. Do you agree or disagree with the following statements? “Want to get out of farming” Index Criteria

I would not want to do any other kind of work	Disagree
I would take full time employment if I were offered a job	Agree
I regard my agricultural activities as the legacy I want to leave for my family	Disagree

Sample: Smallholder farmers, n=310

reflects one’s individual experience and opportunity, versus a true intent to leave farming. Only a small group, consisting of less than 12 percent of the survey sample (n=310), shows a more hardened intent to leave farming. This group (Table 7), while relatively small, said they “would like to do other kinds of work,” “would take full-time employment if I were offered a job,” and “do not regard my agricultural activities as

the legacy I want to leave for my family.” This indexed subgroup of smallholder farmers is very similar to the entire sample across many demographics. The two distinguishing demographics for this subgroup are age and region of the country; this subgroup is younger (under the age of 40) than the population of smallholder farmers (Table 8) and is concentrated in the Western region of the country.

TABLE 8. Do you agree or disagree with the following statements?

Group	All smallholder farmers n=2,771	Smallholder farmers who want to “get out” n=310
Age 15–39	65%	76%
Age 40+	35%	24%
Central region	15%	18%
Eastern region	33%	27%
Northern region	23%	12%
Western region	29%	43%

Sample: Smallholder farmers

2. SMALLHOLDER HOUSEHOLD DYNAMICS IN UGANDA: INCOME AND EXPENSES

Farming activities determine household income

The majority of Ugandan smallholder households generate income from agriculture, and most of that household income comes from growing and selling crops. It is likely the household undertakes other activities to supplement income; however, the household does not report income from these activities at a rate that comes close to the income from farming.

Four-fifths of farmers report their primary job (i.e., where they spend the most of their time) is farming (Figure 34); 80 percent grow something to sell, and 35 percent rear livestock, poultry, fish, or bees.

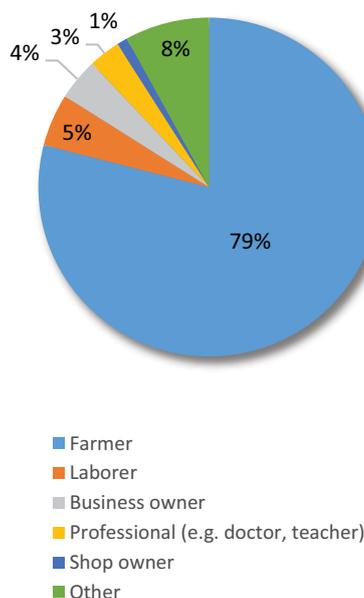
The percentage of Ugandan smallholder households who earn income through other means is fairly limited. Only a small portion (5 percent) are also business or shop owners, and only about one-tenth of farmers have occasional

jobs that yield wages. Roughly one-fifth receive money from family and friends (Figure 35). Over one-third of farmers get income from rearing livestock, poultry, fish or bees. Income sources are relatively stable across demographics.

Smallholder farmers who contribute to the income of their households consistently shared that growing and selling crops are the most important, most reliable and most enjoyable farming activities (Table 9). By comparing these three concepts, data show that a large portion of smallholder farmers in Uganda equate the most important income source with the one they like getting the most and with the one that is the most reliable. A much smaller percentage said the money they earn from rearing livestock, poultry, fish, or bees is the most rewarding.

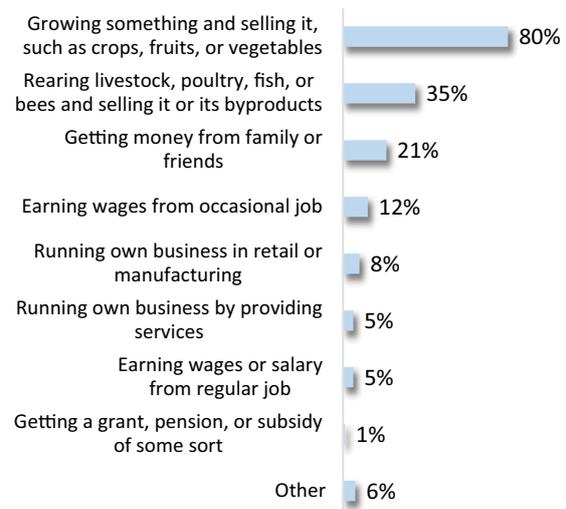
Aside from crop production and livestock, a few smallholder households earn income from other agricultural activities or sources (Figure 36). Very small

FIGURE 34. What is your primary job?



Sample: Smallholder farmers, n=5,517

FIGURE 35. Do you generate income from any of the following sources?



Sample: Smallholder farmers, n=5,517
Multiple responses allowed

TABLE 9. Which of the following income sources is...?

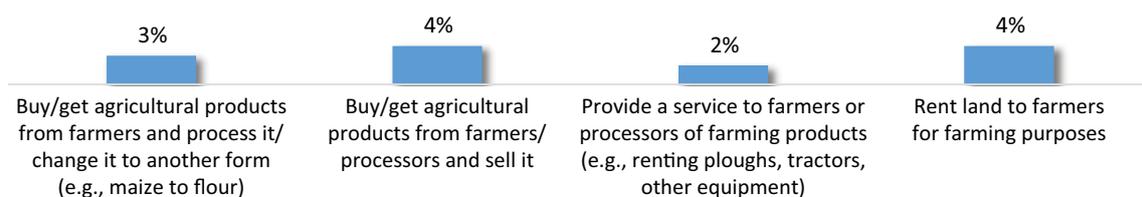
Income sources	Most important	Like getting the most	Most reliable
Growing something and selling it, such as crops, fruits, or	67%	65%	64%
Rearing livestock, poultry, fish, or bees and selling it or	6%	7%	7%
Getting money from family or friends	6%	6%	6%
Earning wages from occasional job	5%	5%	5%
Running own business in retail or manufacturing (selling or making goods)	4%	4%	4%
Earning wages or salary from regular job	4%	4%	4%
Running own business by providing services	2%	3%	3%
Getting a grant, pension, or subsidy of some sort	<1%	<1%	<1%
Other	4%	4%	4%
Don't know	1%	1%	1%

Sample: Smallholder farmers, n=5,517

percentages of farmers are involved in the processing of agricultural products, resell or rent land to other farmers for growing crops.

More broadly, beyond agriculture, only 1 percent of smallholder households receive payments from the government, such as pension, disability or welfare (Figure 37). Of the small percentage that

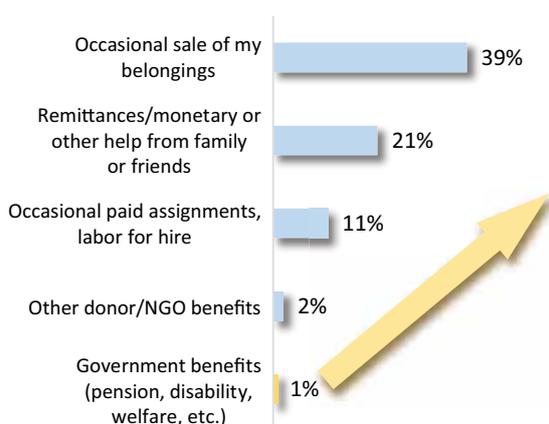
does, nearly half of farmers pick up the money in cash, in person, while one-third receive it via direct deposit to a bank account (Figure 38). Comparatively, the nationally representative Financial Inclusion Insights survey of Ugandan adults in 2015 showed that 6 percent of Ugandan's adults receive G2P payments through a bank, and 2 percent through mobile money.¹⁸

FIGURE 36. Are there any other ways that you get income?

Sample: Smallholder farmers, n=5,517
Multiple responses allowed

18 Intermedia Uganda Financial Inclusion Insights (FII) Tracker survey Wave 3 (N=3,000, 15+), July-August 2015.

FIGURE 37. Do you receive income from any of the following?



Sample: Smallholder farmers, n=5,517
Multiple responses allowed

FIGURE 38. How do you usually get this government payment?



Sample: Smallholder farmers who receive income from government benefits, n=82
Multiple responses allowed

Self-reported expenses are within income; still, smallholders struggle to get by

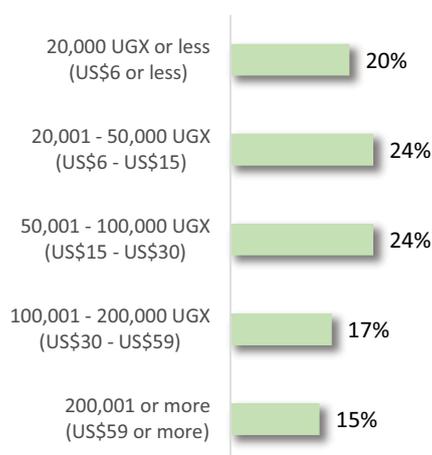
Smallholder farmer households largely live below the poverty line, earning under US\$2.50 a day, or, in extreme poverty, earning under US\$1.25 a day (Figures 11 and 12). One-fifth of households said their expenses are 20,000 UGX (US\$6) or less each month. Twenty-four percent said they need between 20,001 and 50,000 UGX (US\$6 and US\$15), and another 24 percent said they need between 50,001 and 100,000 UGX (US\$15 and US\$30). The rest, approximately one-third of smallholder households, require 100,001 UGX (US\$30) or more per month to manage their household (Figure 39).

Household income in Uganda usually surpasses expenses, leaving majorities of farming households in a slightly better financial situation month to month. This phenomenon should not be taken for granted. The CGAP national survey of smallholder households in Mozambique shows a different tendency, where

smallholder families barely break even each month and typically have to spend more than they earn.¹⁹

In Uganda, most households need 100,000 UGX or less to survive each month (Figure 39). More than three-quarters of households bring in more than what they need each month.

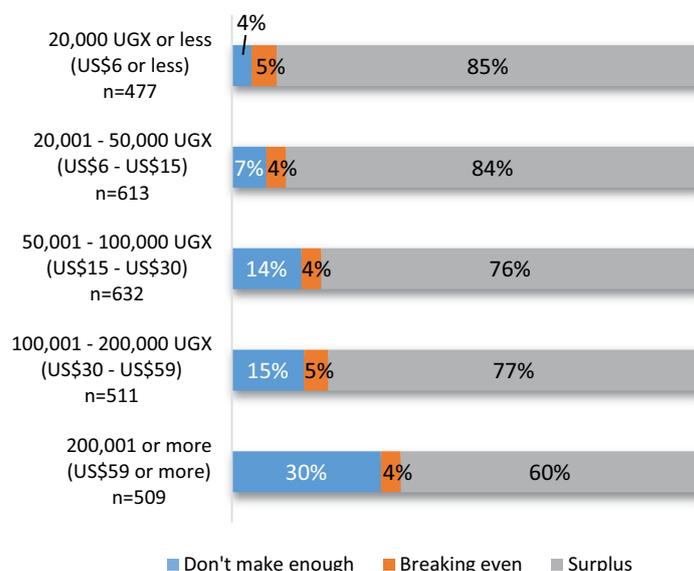
FIGURE 39. What is the minimum amount your household needs to survive per month (for personal expenses)?



Sample: Smallholder households who gave a minimum amount for households' survival n=2,742

¹⁹ CGAP National Surveys & Segmentation of Smallholder Households in Mozambique, 2015–2016; <http://www.cgap.org/publications/national-survey-segmentation-smallholder-households-mozambique>

FIGURE 40. What is the minimum amount your household needs to survive per month (for personal expenses) by household's average monthly income across all sources of money that your household receives?



Sample: Smallholder households, n=2,742

It is households that need more to survive, however, that are more vulnerable to falling short each month. For instance, three in 10 households requiring 200,001 UGX or more per month fall short. This is more than double the percentage of those earning between 50,001 and 100,000 UGX each month (Figure 40). While lower income households are vulnerable, we see more budgeting within means, and a self-reported lower incidence of falling short. The self-reported data also suggest there is a little bit of extra money each month for the lower-income households that can be redirected into a financial account, potentially increasing this group's attractiveness as a consumer segment. Certainly, the experience of falling short is far more pronounced in the higher income groups.

Expenses for smallholder households in Uganda vary in frequency, depending on the size of the expense. Compared with

smallholders in Mozambique,²⁰ these expenses fit into a traditional spending framework where households make smaller expenses more regularly and larger expenses less often (Figure 41).²¹ For instance, grocery expenses, transportation and bills (including utilities, rent or airtime) are more frequent expenses.

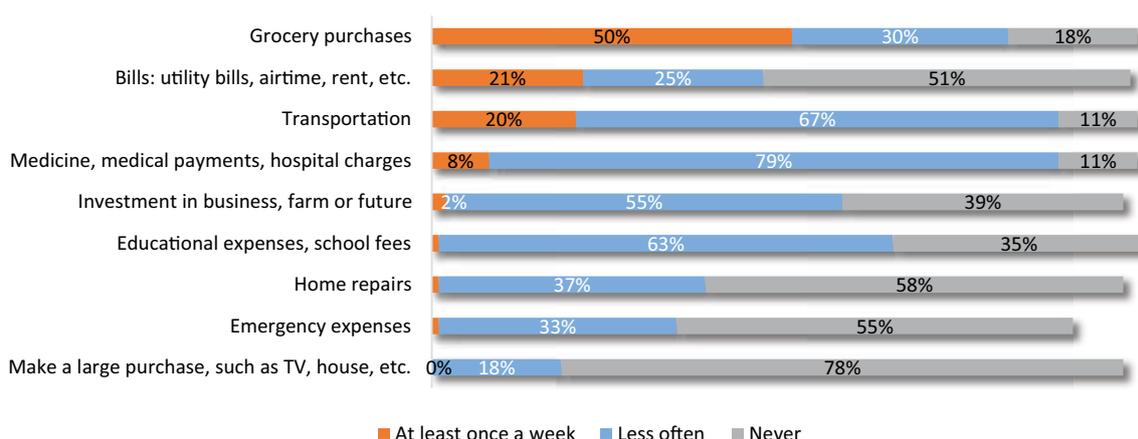
Conversely, other larger expenses are made on an infrequent basis (if at all), including educational expenses, emergency expenses, or home repairs.

There is little to no difference between the spending behaviors of male and female smallholder farmers in Uganda. Households in urban areas have these expenses more often than those in rural areas do.

This research surfaced that transactions that one would expect to be made with some regularity, such as utility bills, were not made in the recent past. Very few

²⁰ Ibid.

²¹ Expense question displayed in Figure 42 did not include agricultural inputs, such as seed and fertilizer, specifically, and instead focused on broad-based household needs. Farming was only specific as a part of investments.

FIGURE 41. How often do you make each of the following expenses?

Sample: Smallholder households, n=5,517

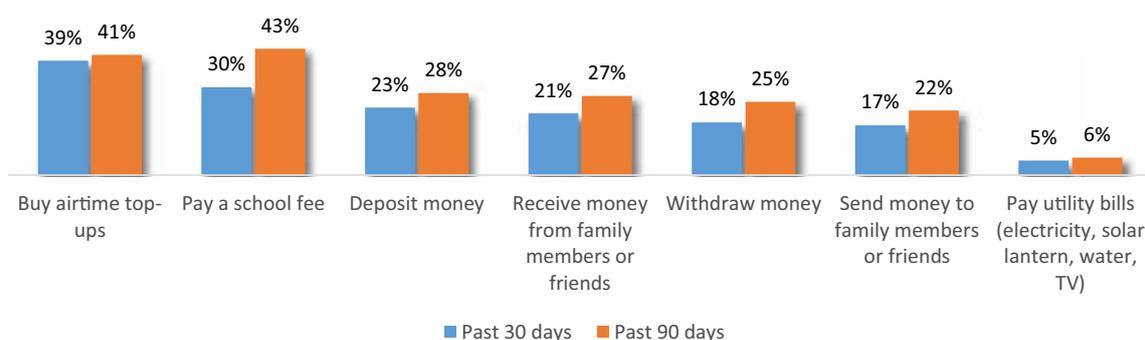
farming households had paid utility bills in the past 30 or 90 days. Only about a quarter had received money from family or friends, and another quarter had deposited money (Figure 42).

The limited outward expenditures of households, compiled with the known expenses, and the recognized distress that surrounds household budgets appeared as a perplexing phenomenon within the data. Households have little resources, typically bring in limited funds, and are still obligated to pay school fees and household costs, yet are not transacting with reported frequencies. This could be due to households making extremely prudent decisions about what to spend and where to spend it, even if it means cutting back on necessities.

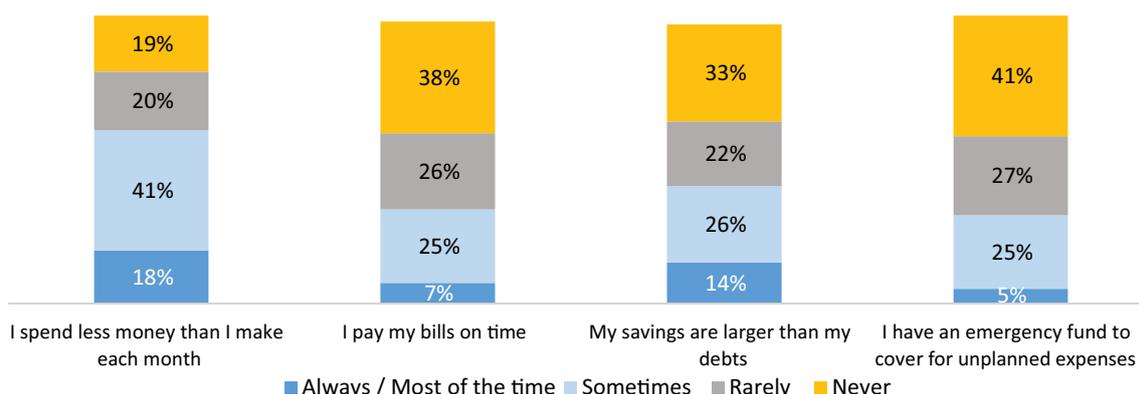
Risky money management practices with few options to mitigate an emergency

Smallholder farmers in Uganda find themselves in at-risk situations. That farmers endeavor to avoid troubling financial circumstances, and self-reported income outweighs expenses for most suggests otherwise, however, even still, farmers profess to struggle in a variety of ways.

The self-reported characterization of monthly spending matches what self-reported actual spend in monetary units (Figures 39 and 40). Fewer than two in 10 smallholders in Uganda feel they always or most of the time spend more than they make. Ugandan smallholder farmers also share that they often

FIGURE 42. Did you do the following activities AT LEAST ONCE in the past 30/90 days?

Sample: Smallholder farmers, n=2,771

FIGURE 43. How often does the following apply to you?

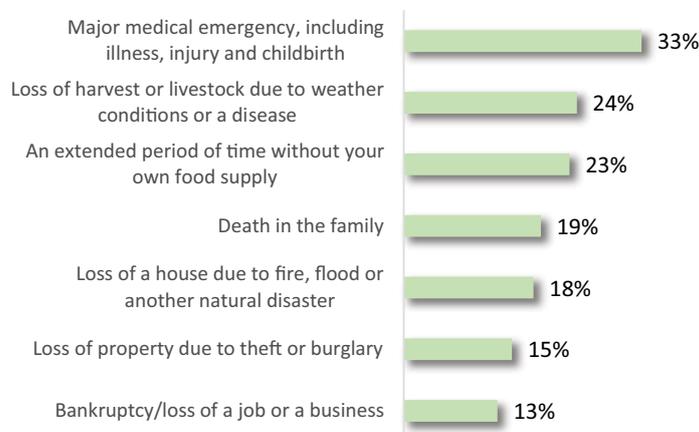
Sample: Smallholder farmers, n=2,771

cannot pay their bills on time. This could potentially support the theory that they make tough decisions about what to pay and what not to pay each month in order to live within their monthly incomes (Figure 43), even though we also see that their reported expenses typically are less than income (shown earlier).

Having more savings than debt is not a guarantee, nor is having an emergency fund. In fact, it is more likely that smallholders never or rarely have these than have them. Life circumstances often mean smallholder households need extra time to pay back loans or lines of credit. Lack of a monthly surplus (either income or agricultural production)

also means they do not have an emergency fund for unplanned expenses (Figure 43).

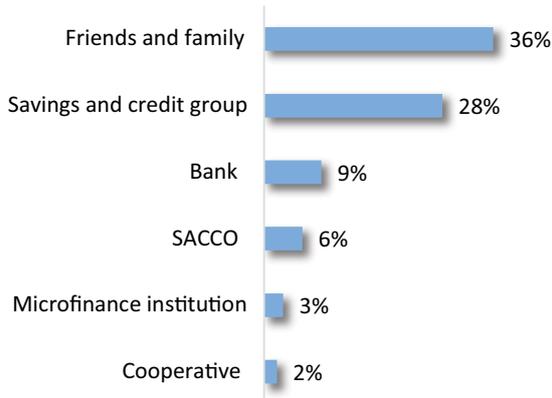
Most smallholder households in Uganda do not have plans to manage unexpected expenses. Just over one-third have a plan to cover expenses associated with a major medical emergency (Figure 44). Much smaller numbers of farmers have plans to respond to a death in the family, events that affect their crops or livestock, or the lack of food. The lack of planning was mirrored by their saving habits over the past year. Few save, and even fewer save at a financial institution (Figure 45). Only 9 percent said they have saved at a bank in the past

FIGURE 44. Does your family have a plan to manage these unexpected expenses, which might result from the following?

"Yes" answers

Sample: Smallholder farmers, n=2,771

FIGURE 45. In the past 12 months, have you saved money with any of the following groups?



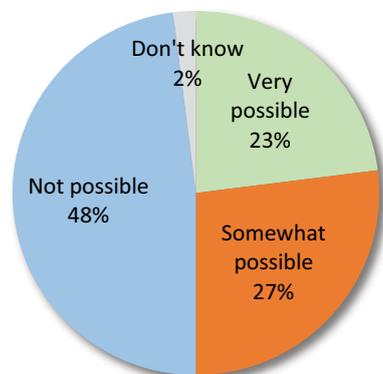
"Yes" answers

Sample: Smallholder farmers, n=2,771

12 months; however, informal saving is much higher, and over one-third have saved with friends and family. Reflecting on earlier observations, disparities between income and expenses limit their ability to put money aside.

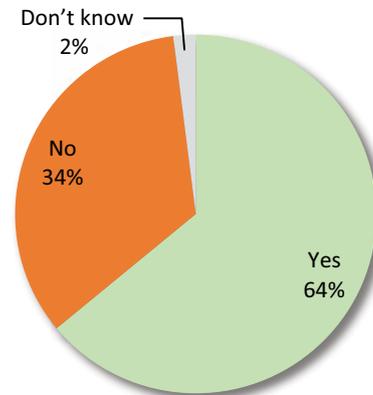
Limited savings leaves smallholder households in a very risky position, especially because there are not many

FIGURE 47. Imagine that you have an emergency and you need to pay 114,000 shillings. How possible is it that you could come up with 114,000 shillings within the next month?



Sample: Smallholder farmers, n=2,771

FIGURE 46. In the event of an emergency, could you get extra money through relatives sending money or by selling assets?



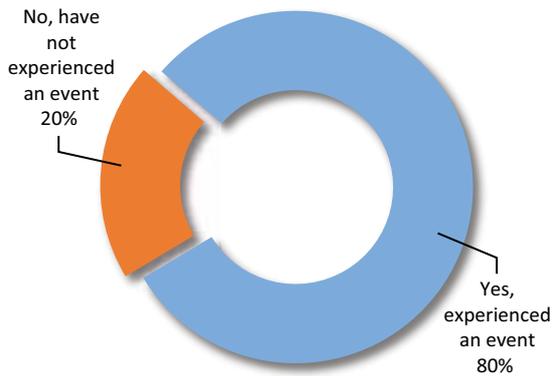
Sample: Smallholder farmers, n=2,771

other options for liquidity. The majority of Ugandan smallholder farmers *think* they could get extra money from relatives sending money or by selling some of their assets in the event of an emergency (Figure 46). Still, the possibility of coming up with a relatively small amount of money—114,000 shillings (approximately US\$34)²²—in the next month causes some pause. Less than one-quarter said it was very possible (Figure 47). Half of smallholders said it was either not possible or they did not know if it was possible to come up with this money in a month. For those who said it would be possible, they would most likely draw the money from family or friends or get the money from their limited savings.

Unable to cope with negative events that affect them

Four-fifths of smallholder farmers in Uganda endured financial shocks and events in the year prior to this survey (Figure 48). A significant number of smallholder farmers experienced multiple financial shocks over the past year;

²² This amount was derived from the World Bank Global Findex question series, which tests whether respondents could come up with a nominal amount, set at 1/20th GNI per capita in local currency. Source: <http://bit.ly/1QqNaHl>.

FIGURE 48. In the past 12 months, have you experienced any events?

Sample: Smallholder farmers, n=2,771

approximately two-fifths experienced two or more of these events in the past year. The most frequently reported event was a medical emergency, followed by a death in the family (Figure 49).

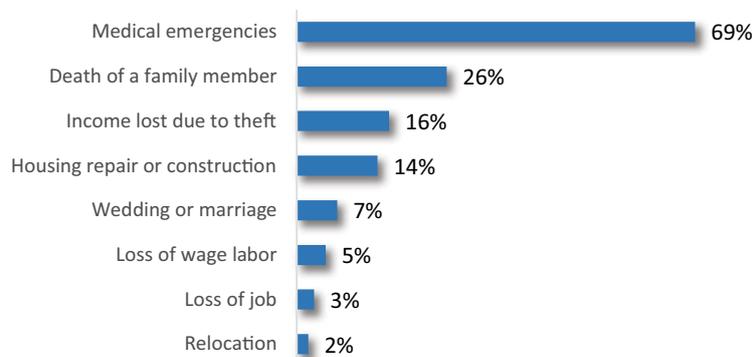
Smallholder farmers feel weather poses the greatest risk to their households' agricultural activities (Figure 50). They also experience nonweather-related risks. In the past three years, more than four-fifths of smallholders had their agricultural activities seriously affected by a weather-related event, and almost three-quarters of smallholders were affected by pests or diseases (Figure 51).

Overall the regions of Uganda face the same type of events, but there are some regional nuances. Problems with pests

or diseases are more prevalent in the Central region; weather is a major issue in the Western region (Figure 52). Across all experienced events, the majority said they did not do anything, or at least did not do anything special, to cope with the challenges (Figure 53). For two of the top three events—weather/diseases or unexpected price fluctuations in the market—less than one-quarter said they actually did something about it, such as taking a temporary job, borrowing money, using some of their savings, or selling livestock or assets.

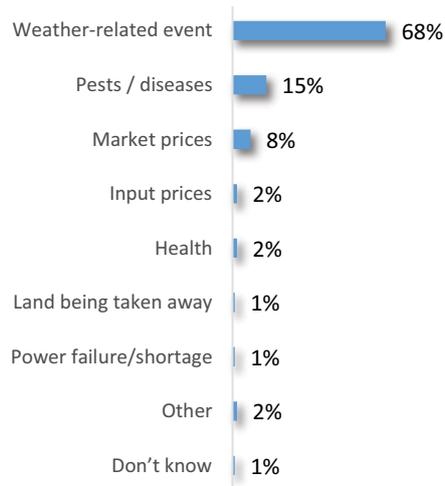
An intermittent water supply affects growth

A significant portion of smallholder farmers in Uganda finds that their households' farming activities are limited by the amount of available water. Two-fifths have an intermittent supply of water, and their lack of access to water affects their agricultural production (Figure 54). Another quarter have enough for their farm, but are unable to grow their agricultural activities quickly because of their water supply situation. Just over one-third said they have enough water for their agricultural activities or that their intermittent water supply does not affect the farm.

FIGURE 49. In the past 12 months, have you experienced any of these events?

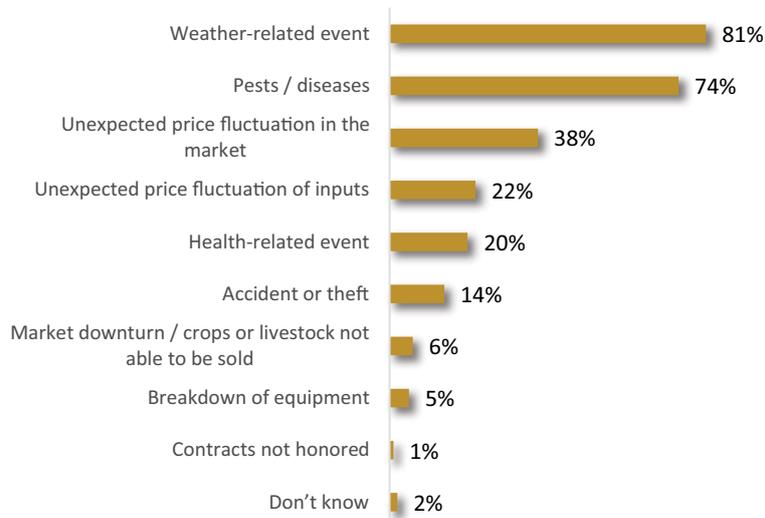
Sample: Smallholder farmers, n=2,771
Multiple responses allowed

FIGURE 50. What poses the most significant risk to your agricultural activities?



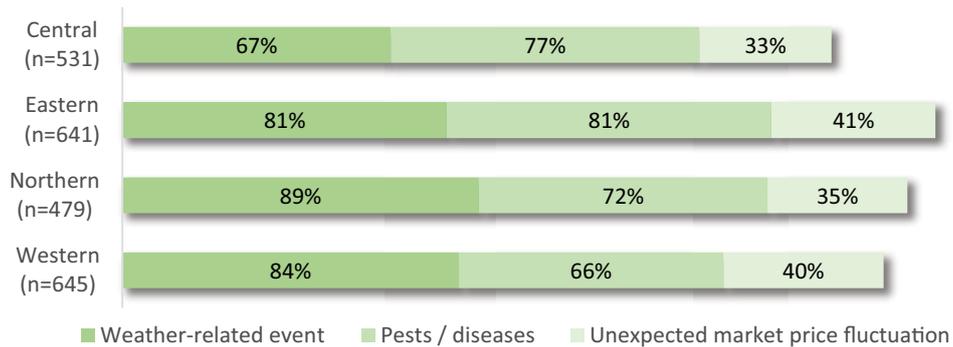
Sample: Smallholder farmers who participate in household's agricultural activities, n=2,296

FIGURE 51. Have your agricultural activities been seriously affected by any of the following events in the past three years?



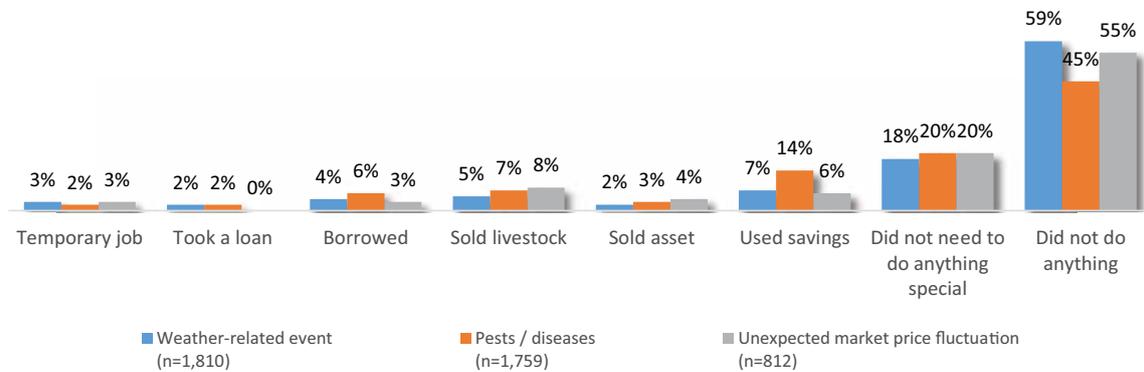
Sample: Smallholder farmers who participate in household's agricultural activities, n=2,296

FIGURE 52. Have your agricultural activities been seriously affected by any of the following events in the past three years?



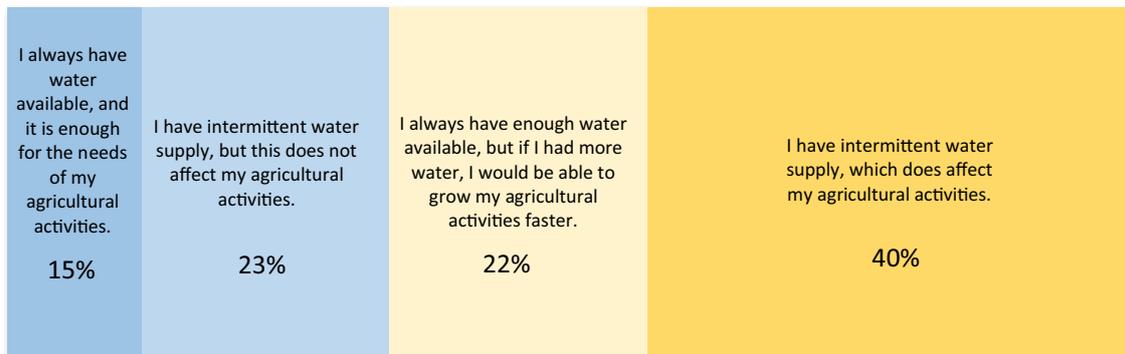
Sample: Smallholder farmers who participate in household's agricultural activities in each region

FIGURE 53. How did you mainly cope when this happened?



Sample: Smallholder farmers who say their agricultural activities have been seriously affected by each category

FIGURE 54. Which of the following best describes your water situation?



Sample: Smallholder farmers who participate in household's agricultural activities, n=5,203

3. AGRICULTURAL RISKS AND MITIGATION AMONG SMALLHOLDER HOUSEHOLDS IN UGANDA

Smallholder farmers try to mitigate their agricultural risks

Agricultural risks are a reality for smallholder farmers in Uganda. Their life experiences have taught them to recognize their own vulnerabilities. Drought, flood and disease, along with lower-than-expected yield or insufficient crop storage are both known and real concerns. In concert with smallholder farmer aspirations for themselves and their farms, there is an importance placed on risk mitigation as well as an aspiration to be better equipped to mitigate risk.

Majorities of smallholder farmers see the importance of keeping money aside for certain agricultural needs, most notably seeds and fertilizer (Figure 55). Fewer find it imperative to keep money aside for security, fuel and irrigation.

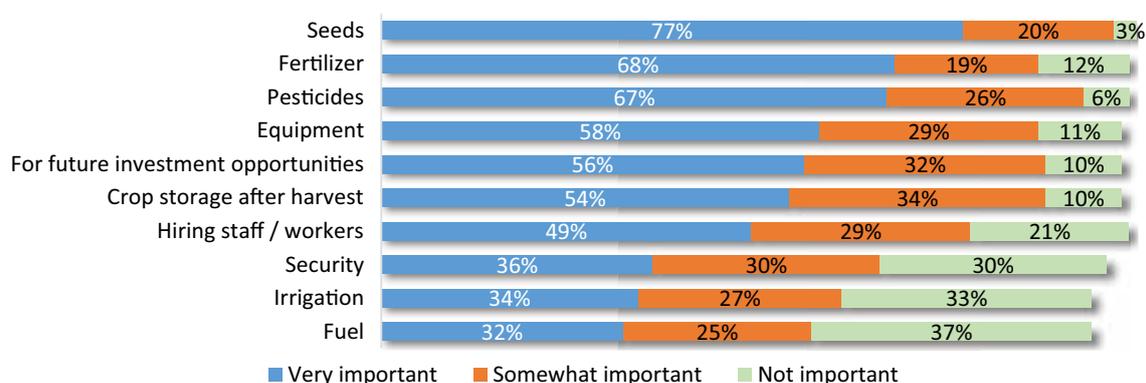
Where we see conflict is between intention and ability to mitigate risk (Figure 56). Most smallholder farmers in Uganda want to be able to set money aside for their agricultural needs. In fact, recognized importance of setting aside money is often more than double that of actual practice. For instance, while

93 percent want to be able to set aside money for seed, only 40 percent are actually able to do so. The gaps for saving for pesticides, equipment, storage, irrigation, fertilizer and even water are much larger.

Although they may not be keeping money aside for their agriculture needs, Ugandan smallholders are storing crops. Nearly three-quarters currently store their crops after the harvest (Figure 57). The most commonly stored crop is maize followed closely by beans (Figure 58), matching the most commonly grown crops, and those that are perceived as most important. Storage focuses almost exclusively on food or staple crops and not cash crops. The storage location is normally the home (Figure 59). The main reason for storing crops is so the family can consume them later, further emphasizing the dependence on their own farms for subsistence (Figure 60).

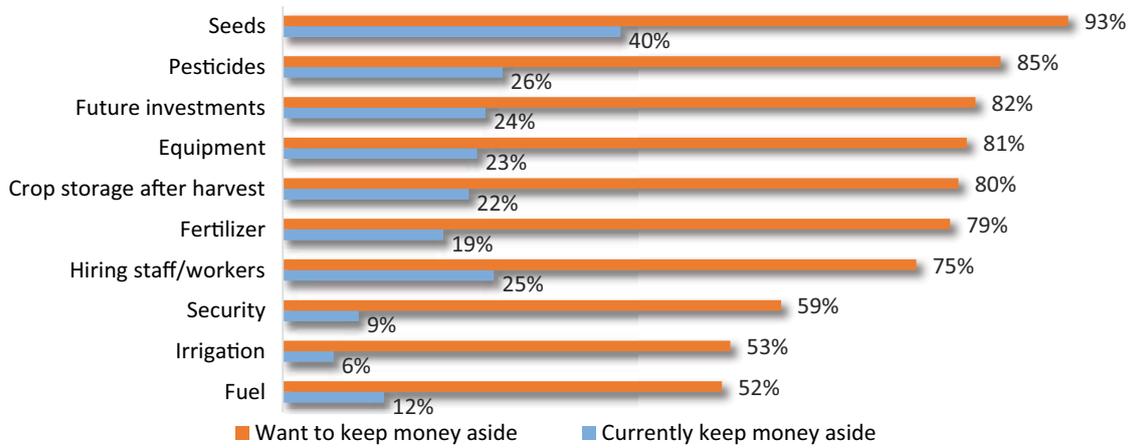
Approximately one-quarter of smallholder farmers do not store their crops after the harvest (Figure 61), mostly because no crops remain. They are sold, traded, or consumed by the families (Figure 62). Less than one-quarter of farmers do not store their crops because they lack access to storage facilities.

FIGURE 55. How important is it to keep money aside for the following agricultural needs?



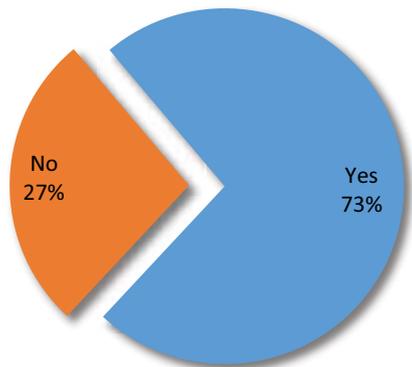
Sample: Smallholder farmers who participate in household's agricultural activities, n=2,296

FIGURE 56. Do you want to keep money aside for any of the following agricultural needs? vs. Do you currently keep money aside for any of the following agricultural needs?



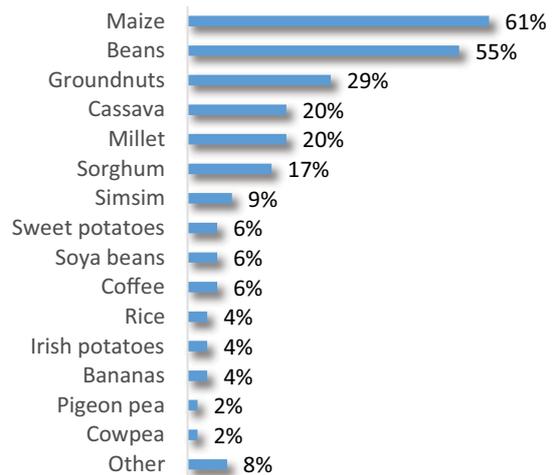
Sample: Smallholder farmers who participate in household's agricultural activities

FIGURE 57. Do you currently store any of your crops after the harvest?



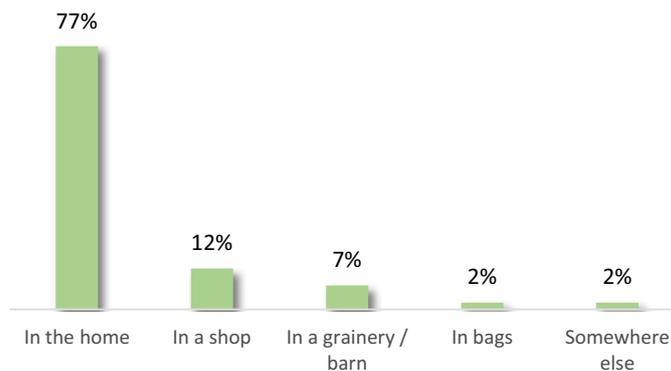
Sample: Smallholder farmers who participate in household's agricultural activities, n=2,296

FIGURE 58. Which crops do you normally store?



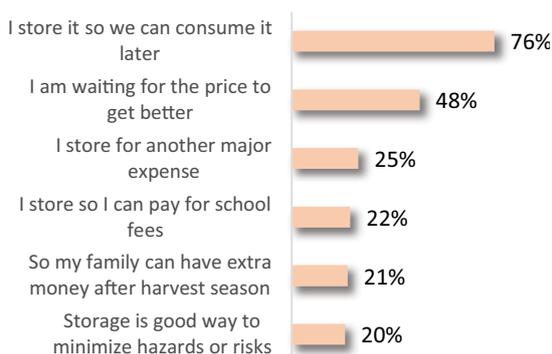
Sample: Smallholder farmers who currently store any crops after harvest, n=1,633

FIGURE 59. Where do you store your crops?



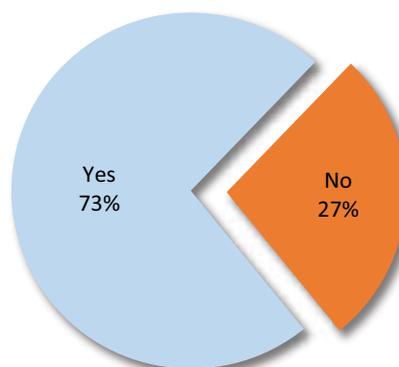
Sample: Smallholder farmers who currently store any crops after harvest, n=1,633

FIGURE 60. Why do you store your crops?



Sample: Smallholder farmers who currently store any crops after harvest, n=1,633
Multiple responses allowed

FIGURE 61. Do you currently store any of your crops after the harvest?



Sample: Smallholder farmers who participate in household's agricultural activities, n=2,296

Investing in livestock also helps households mitigate risk; a significant number of Ugandan smallholder farmers have made this type of investment. More than two-fifths have ever purchased livestock as an investment, and a large portion of those said they currently have any (Figure 63). This is in stark contrast to Mozambique,²³ where less than 10 percent currently practice this form of risk mitigation.

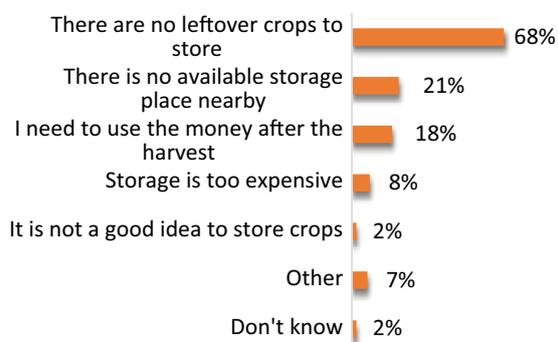
Agriculture revolves around family

Smallholder farmers in Uganda view their households' agricultural activities as their

households' business. They tend to rely primarily on themselves and their families for labor to support all of these activities and use their family and friends as sources of information. They turn to family for help first when they need it. A small minority do not use any help to manage the land or livestock (Figure 64). Of those who do use labor, it is throughout all phases of the harvest (Figure 65). Much smaller numbers of farmers use labor for selling crops or for the care or sale of livestock.

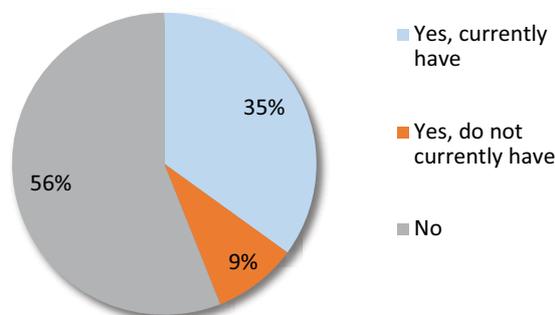
Farmers turn to their family and friends most often and frequently for

FIGURE 62. Why do you not currently store any of your crops?



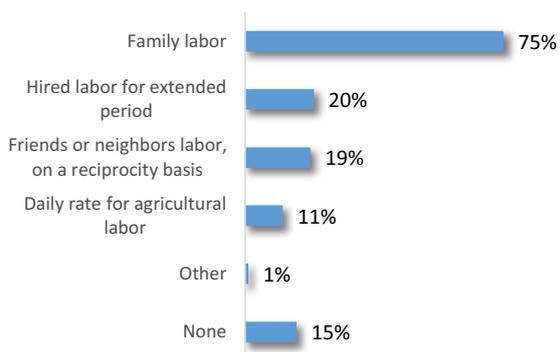
Sample: Smallholder farmers who currently do not store any crops after harvest, n=663
Multiple responses allowed

FIGURE 63. Have you ever purchased livestock as an investment?

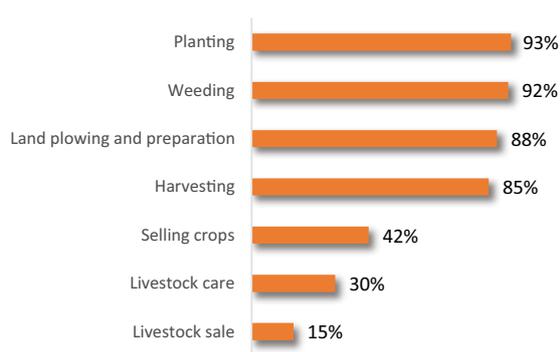


Sample: Smallholder farmers who participate in household's agricultural activities, n=2,296

23 CGAP National Surveys & Segmentation of Smallholder Households in Mozambique, 2015-2016; <http://www.cgiar.org/publications/national-survey-segmentation-smallholder-households-mozambique>.

FIGURE 64. For managing the land and livestock, what types of labor do you use?

Sample: Smallholder farmers who participate in household's agricultural activities, n=5,203
Multiple responses allowed

FIGURE 65. What do you use the labor for?

Sample: Smallholder farmers who use labor for managing land and livestock n=4,437
Multiple responses allowed

information on agricultural activities, followed closely by messages delivered via the radio (Table 10). All other sources are used less frequently, with some getting only single digits for frequent use. Men and women have similar tendencies when it comes to the sources they turn to for agricultural information. This suggests there are limited

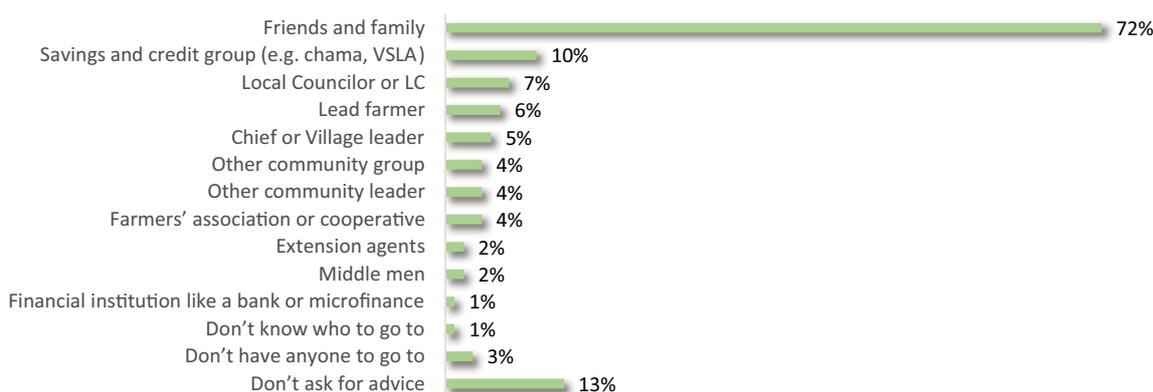
information sources, and many farming households might be working from the same information passed around the village, person to person.

Friends and family are also the first sources for financial advice. Nearly three-quarters of smallholders go to them first, and no other source rates above

TABLE 10. How often do you use each of the following sources of information for agricultural activities?

	Daily	Weekly	Monthly	More than monthly	Never
Friends or family members	23%	20%	18%	18%	20%
Radio	27%	20%	10%	13%	28%
Community members	5%	13%	17%	19%	43%
Religious leaders	1%	22%	10%	12%	54%
Input suppliers	<1%	3%	9%	17%	66%
Cell phone/SMS	10%	7%	6%	7%	68%
Government officials	<1%	1%	5%	19%	70%
Rural development agents/NGOs	<1%	2%	7%	15%	73%
Government extension workers	<1%	<1%	4%	17%	75%
Merchants	<1%	2%	6%	9%	78%
Intermediaries/middlemen	<1%	1%	4%	11%	80%
School teachers	1%	3%	4%	8%	80%
Newspapers/magazines	1%	3%	4%	6%	84%
Television	1%	2%	2%	4%	89%
Internet	<1%	<1%	<1%	1%	96%

Sample: Smallholder farmers who participate in household's agricultural activities, n=2,296

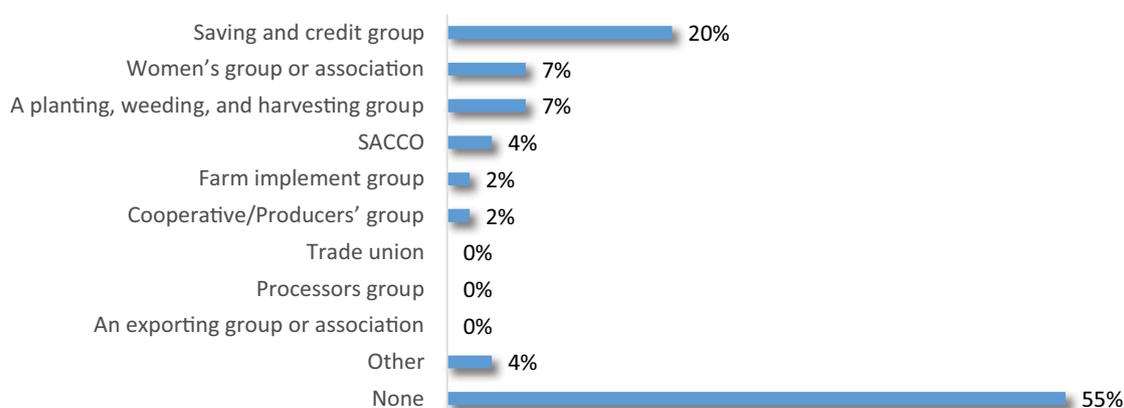
FIGURE 66. When it comes to financial or income-related advice, who do you regularly talk to?

Sample: Smallholder farmers, n=2,771
Multiple responses allowed

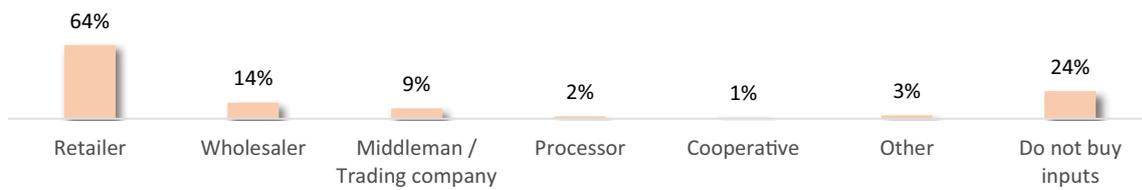
10 percent (Figure 66). Only a small portion of smallholder farmers in Uganda (both men and women) turn to any groups or associations related to farming, saving or credit; the majority of smallholders are not members of any of these. The highest percentage, one-fifth, are members of a saving and credit group (Figure 67). The concentration on family and friends as a source of financial advice, combined with the very limited exposure to other outside sources, suggests there could be a lack of information channels for bringing in new, current and relevant news about financial mechanisms into smallholder farming communities in Uganda.

Transactions are entirely cash-based and without contracts

Approximately three-quarters of smallholder farmers in Uganda are purchasing agricultural inputs of any kind (fertilizer, seed, etc.), and buy them largely from retailers. Small portions of these farmers buy from wholesalers and middlemen. Purchasing inputs from processors and cooperatives is less common (Figure 68). Transactions, across all sources, tend to be in cash, paid at the point of purchase (Figure 69). Very few farmers even have an option to pay later (Figure 70), which can be a source of strain for their budgeting and planning.

FIGURE 67. Are you a member of any of the following groups or associations?

Sample: Smallholder farmers who participate in household's agricultural activities, n=2,296
Multiple responses allowed

FIGURE 68. Who do you normally purchase your agricultural and livestock inputs from?

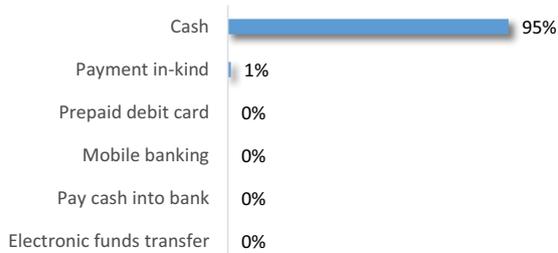
Sample: Smallholder farmers who participate in household's agricultural activities, n=5,203
Multiple responses allowed

Most smallholder farmers in Uganda sell directly to the public, usually at a local market or in the village (Figure 71), and that behavior might be driven more by access than by choice. The majority of smallholder farmers lack the means to get their crops and livestock to other markets (Table 11). Only approximately half of smallholder farmers in Uganda believe they get the best price at the location where they sell their crops and livestock.

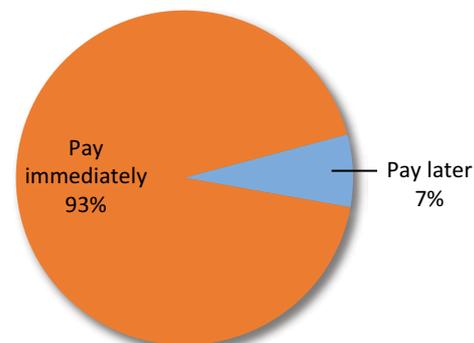
Adding further complexity, just over half get the current market price for their goods (Figure 72). The most common reason that smallholders report that they do not get the current market price is that they are taken advantage of by customers, followed closely by having

too few customers (Figure 73). Transportation seems to be less of an issue for this group.

In addition to capturing where farmers bring their goods to sell (Figure 71), the survey also asked to whom they sell their goods. There are also close to three in five who will sell to a retailer (57 percent) and nearly half sell directly to the public (45 percent) (Figure 74). Nearly all sales happen outside of a formal agreement. Only 8 percent of smallholder farmers have a contract to sell their crops or livestock, leaving the remainder in loose value chains (Figure 75). Transactions are almost exclusively conducted in cash. No other form of payment surpasses 1 percent (Figure 76).

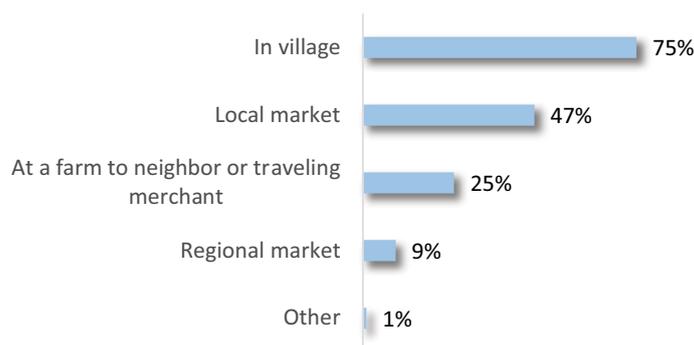
FIGURE 69. How do you usually pay your suppliers of inputs?

Sample: Smallholder farmers who purchase main agricultural and livestock inputs, n=3,983
Multiple responses allowed

FIGURE 70. Do your suppliers give you the option to pay them later or do you have to pay immediately?

Sample: Smallholder farmers who pay suppliers for inputs, n=3,789

FIGURE 71. Where do you normally sell your crops and livestock?



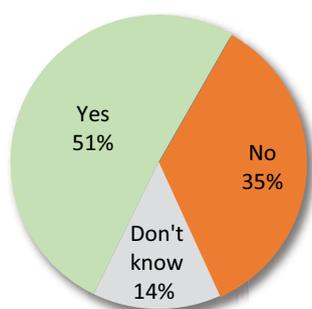
Sample: Smallholder farmers who grow and sell crops, n=4,375
Multiple responses allowed

TABLE 11. Why do you sell your crops and livestock at this location?

I do not have access to transport to other markets	52%
I get the best price at this market	46%
Poor road conditions to other markets	24%
I am not aware of prices at other markets	20%
Other reason	8%
Don't know	2%

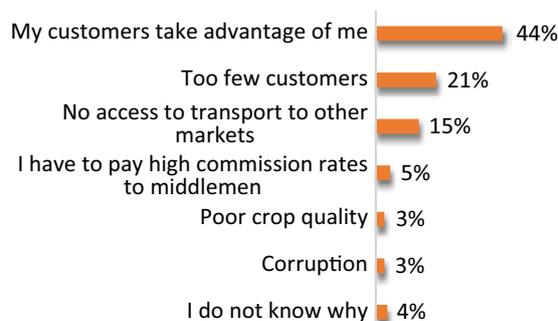
Sample: Smallholder farmers who know where crops and livestock were sold, n=4,363
Multiple responses allowed

FIGURE 72. When you sell your crops and livestock, do you get the current market price?



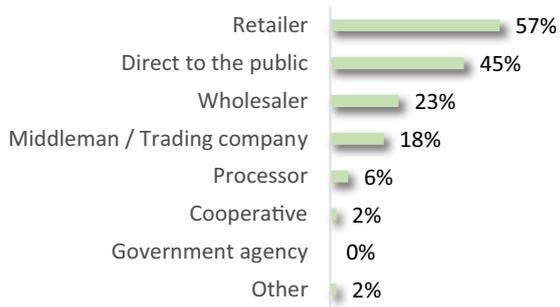
Sample: Smallholder farmers who grow and sell crops, n=4,375

FIGURE 73. Why do you not get the current market price?



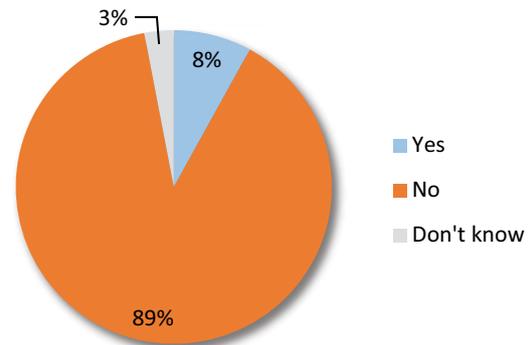
Sample: Smallholder farmers who do not get current market price for crops and livestock sold, n=1,556
Multiple responses allowed

FIGURE 74. Who do you sell your crops and livestock to?



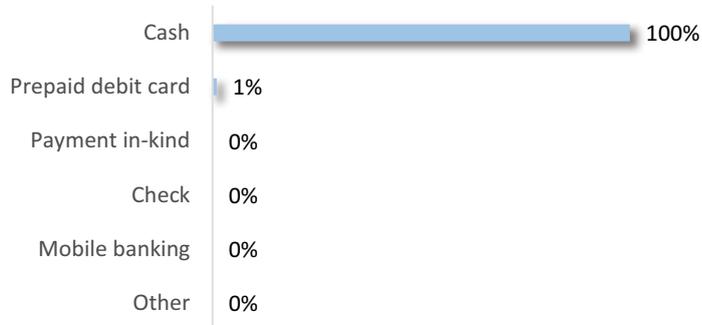
Sample: Smallholder farmers who grow and sell crops, n=4,375
Multiple responses allowed

FIGURE 75. Do you have a contract to sell any of your crops or livestock?



Sample: Smallholder farmers who grow and sell crops, n=4,375

FIGURE 76. How do you usually get paid for what you sell?



Sample: Smallholder farmers who grow and sell crops, n=4,375
Multiple responses allowed

4. MOBILE PHONE TOOLS

Mobile phones: A critical tool that can become a valuable channel for farmers

Mobile phones are very important for smallholder farmers in Uganda, and farmers recognize them as such. A phone's importance, however, is as a communications tool. Farmers do not yet see its greater application or utility for their household or agricultural activities. While mobile phones are familiar, building smallholders' association with activities outside of calls and texts will be critical for developing the phone as more of a digital channel for a household.

Higher perceived importance

Roughly three-quarters of smallholder farmers in Uganda recognize mobile phones as "very important" to their households, or their agricultural activities (Figure 77). The remainder (approximately one-quarter) do not believe mobile phones are as important, or do not see their value to the household or farm. While importance is high overall, it still means that a portion of the marketplace does not have enough context for how they would benefit from a mobile device.

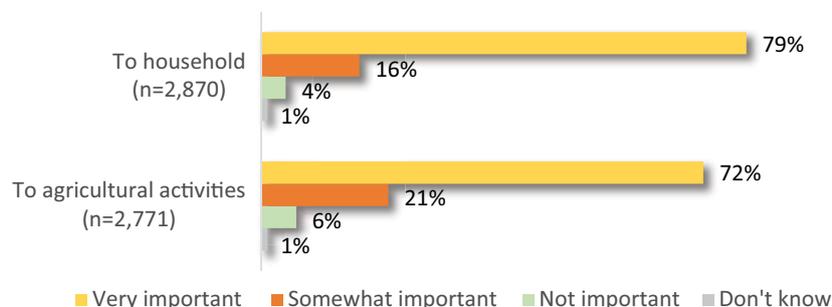
Limited knowledge

Smallholder farmers mainly see mobile phones as a channel for communicating with friends or family. Utility for business and financial transactions is contained to small portions of the population (Figure 78), which demonstrates a disconnect between the perceived importance of mobile phones to their households and agricultural activities, and the use of advanced phone activities. It is imperative to build knowledge and the connection between phone and household and financial transactions and farm.

High current use

Only one-quarter of smallholders in Uganda (27 percent) have never used a mobile phone (Figure 79), indicating a higher familiarity in the market, compared with Mozambique,²⁴ for example. This access, however, is much lower than the national average, where only 15 percent of Ugandan adults have no access to a mobile phone.²⁵ However, those who have used a phone primarily use a basic phone with no internet capability (Figure 80). Smartphone use

FIGURE 77. Regardless of what you have, how important is it to your household/ agricultural activities to have a mobile phone?

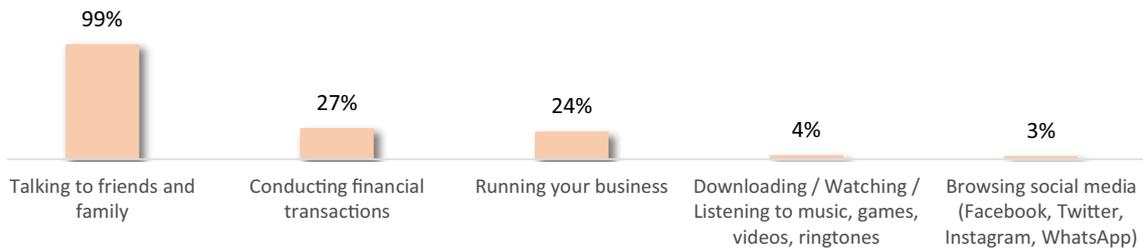


Sample: Smallholder households, n=2,870; Smallholder farmers, n=2,771

24 CGAP National Surveys & Segmentation of Smallholder Households in Mozambique, 2015–2016; <http://www.cgap.org/publications/national-survey-segmentation-smallholder-households-mozambique>.

25 Source: InterMedia Uganda FII Tracker survey Wave 3 (N=3,000, 15+), July-August 2015

FIGURE 78. What are the benefits to having your own mobile phone or SIM card?



Sample: Smallholder farmers who have ever used a mobile phone, n=2,104
Multiple responses allowed

is in the single digits, with only 3 percent of smallholders saying they have used one.

Phone ownership lags use, but only by 4 percent. While 73 percent of smallholder farmers in Uganda have used a phone, only 69 percent actually have a phone in their homes (Figure 81). There can be multiple handsets in the household suggesting that, with exposure, there is recognized utility in the device.

How people use their mobile phones mirrors both perceived knowledge and type of handset. Those with a mobile phone typically use it to make calls or send texts (Figure 82). Less than 15 percent of smallholder farmers are using applications, taking color pictures, browsing the internet or using social networking sites. A small, but significant, portion of smallholder farmers has used their mobile phones for financial

transactions, showing at least a potential for advanced activities.

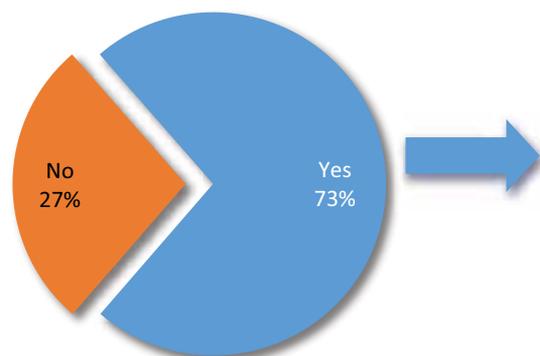
Limited interest for nonusers

Half of those without a mobile phone are decidedly interested in obtaining such a device. An additional 26 percent are somewhat interested. Pure disinterest is contained (19 percent), leaving only 5 percent uncertain of their desire.

Bringing a larger share of consumers to mobile phones will require some value-building, as there is only limited, and tepid interest in using a mobile phone among nonusers. While nonusers are limited to just over one-quarter of smallholder farmers, only half of them would be very interested in using a mobile phone (Figures 83 and 84).

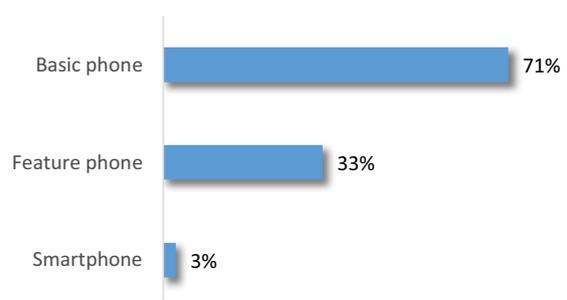
The main reason for not having a mobile phone is cost. More than two-thirds

FIGURE 79. Have you ever used a mobile phone?



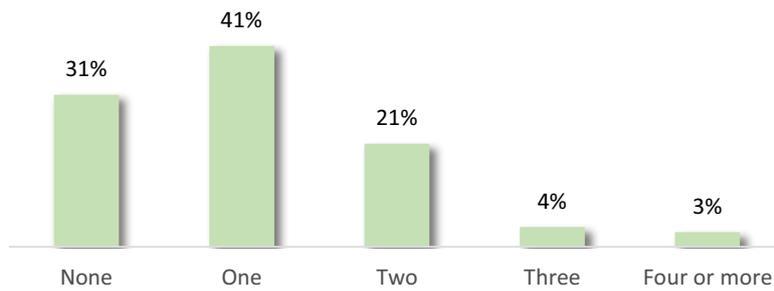
Sample: Smallholder farmers, n=2,771

FIGURE 80. What type of phone have you used?



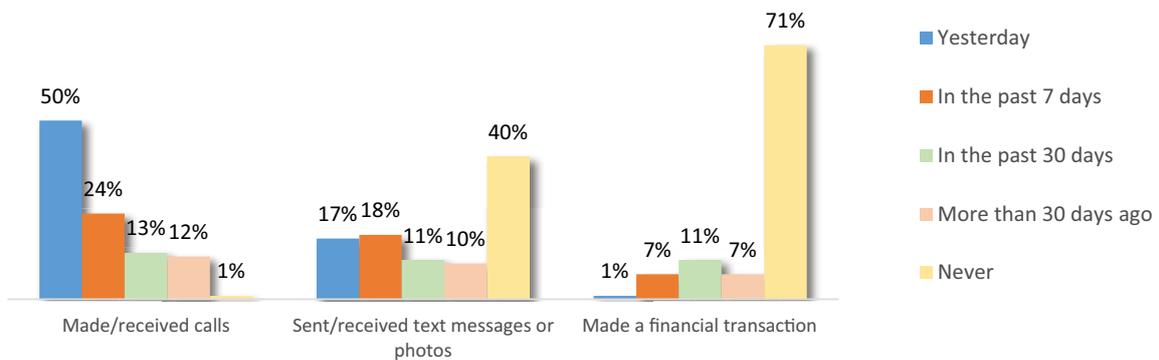
Sample: Smallholder farmers who have ever used a mobile phone, n=2,104
Multiple responses allowed

FIGURE 81. How many people in your household own a mobile phone?



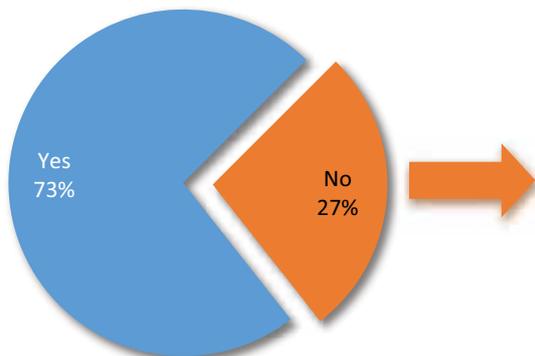
Sample: Smallholder farmers, n=2,870

FIGURE 82. Apart from today, when was the last time you performed the following activities on the mobile phone you use?



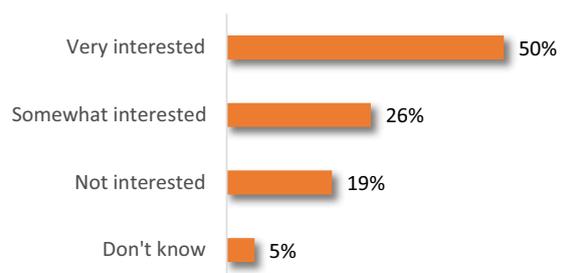
Sample: Smallholder farmers who have ever used a mobile phone, n=2,104

FIGURE 83. Have you ever used a mobile phone?



Sample: Smallholder farmers, n=2,771

FIGURE 84. How interested would you be in using a mobile phone?



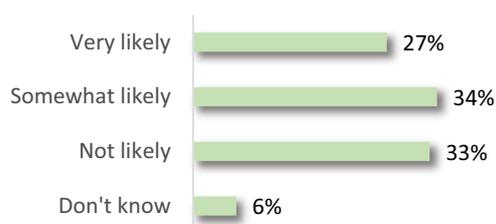
Sample: Smallholder farmers who have never used a mobile phone, n=667

TABLE 12. What is the main reason you do not have a mobile phone?

I don't have money to buy phone	67%
I am not allowed to use a phone by my spouse or family	5%
I don't have money to pay for airtime	4%
I don't have a need to use a phone	3%
There is no place to charge a phone	1%
There is no network where I live/work	1%
Using a phone is against my culture/religion	<1%
No specific reason	3%
Other	15%

Sample: Smallholder farmers who currently do not own a phone but have used a phone, n=657

of smallholder farmers feel they do not have the means to purchase a phone or buy airtime (Table 12). There is interest in purchasing one in the future; over one-quarter of smallholder farmers said they are very likely to purchase one in the next 12 months (Figure 85), reflecting at least their aspirations, if not their actual actions, to purchase a phone if finances permit.

FIGURE 85. How likely are you to purchase a mobile phone in the next 12 months?

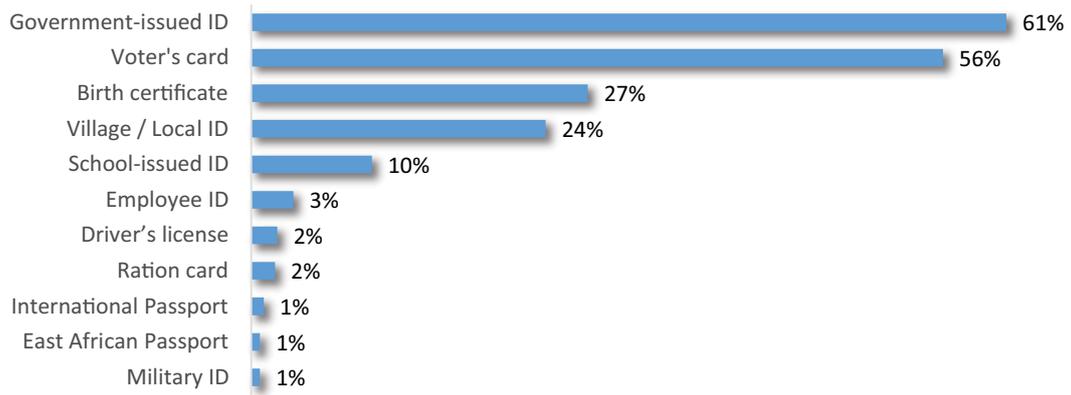
Sample: Smallholder farmers who currently do not own a phone but have used a phone, n=657

Some smallholders lack the necessary identification to open an account

Many smallholders do not have the required national identification (ID) to open a digital financial services (DFS) account, creating a potential—but surmountable—barrier to account ownership. The most prolific form of identification in all cases was a government-issued ID card, which only three-fifths of smallholders in Uganda have (Figure 86). This is despite the ongoing campaign, launched in April 2014, to increase uptake of official IDs in Uganda.²⁶ The next likely form of identification—a voter's card—barely reaches over half of smallholder farmers in Uganda (Figure 86). Across all types of identification tested, men and women were roughly equally likely to possess them. Most of these forms of identification are also less prevalent in rural areas.

²⁶ <http://www.ugandahighcommissionpretoria.com/National-IDs.html>.

FIGURE 86. Do you have any of the following types of an official identification?



Sample: Smallholder farmers, n=5,517
Multiple responses allowed

5. FINANCIAL INCLUSION AMONG SMALLHOLDER HOUSEHOLDS IN UGANDA

Financial inclusion: Value of formal financial institutions is appreciated but not used by smallholders

Uganda is building towards meaningful financial inclusion, showing slow, steady growth in formal financial account ownership in recent years due to increases in mobile money use. The nationally representative Financial Inclusion Insights study of Uganda shows that in 2015, almost four in 10 (39 percent) Ugandans across the country are financially included, having their own full service, registered formal financial account. This is up from one-third (33 percent) in 2013. In 2015:

- Thirty-five percent had their own registered mobile money account
- Eleven percent had their own registered bank account
- Six percent had their own registered account with a nonbank financial institution

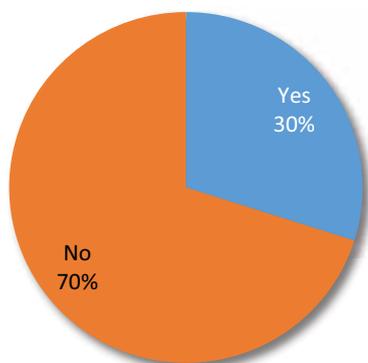
Nationwide, active account ownership also increased. Thirty four percent of all

Ugandans are now active account holders (have used their registered accounts in the past 90 days) versus 30 percent in 2013.²⁷

Smallholder farmers in Uganda lag behind the nation in their exposure to and use of some financial services, which makes them less financially included. Twenty-six percent of Ugandan smallholder farmers currently have a full-service formal, financial product in their own name, characterizing them as “financially included,” as defined in the nationally representative Financial Inclusion Insights survey of Ugandan adults. Overall, smallholders in Uganda lag the national population by 12 points in terms of being financially included.

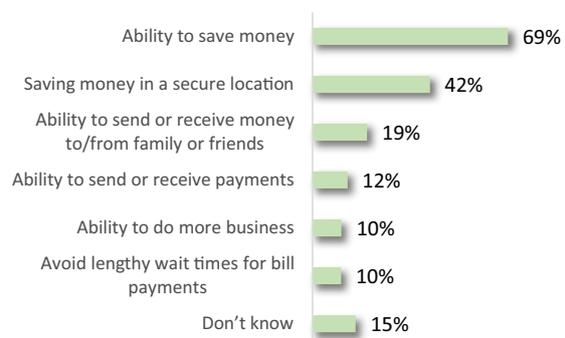
The limited availability of banks in some of the rural areas of Uganda factor heavily into smallholder farmers’ limited access to banks. Less than one-third said they have ever been inside of a bank (Figure 87). The majority of smallholder farmers, regardless of whether they have been inside a bank, consider the ability to save money a key benefit of having a bank account (Figure 88).

FIGURE 87. Have you ever been inside a bank?



Sample: Smallholder farmers, n=2,771

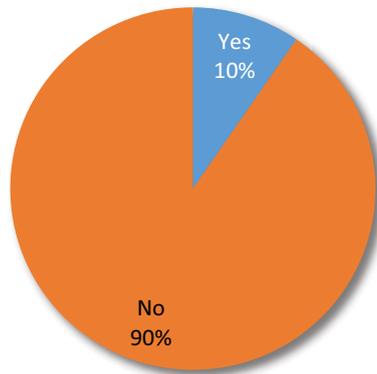
FIGURE 88. What are the benefits to having a bank account?



Sample: Smallholder farmers, n=2,771
Multiple responses allowed

27 InterMedia Uganda FII Tracker surveys Wave 1 (N=3,000, 15+), September-December 2013; Wave 2 (N=3,001, 15+), June-July 2014; Wave 3 (N=3,000, 15+), July-August 2015.

FIGURE 89. Do you personally have a bank account that is registered in your name?



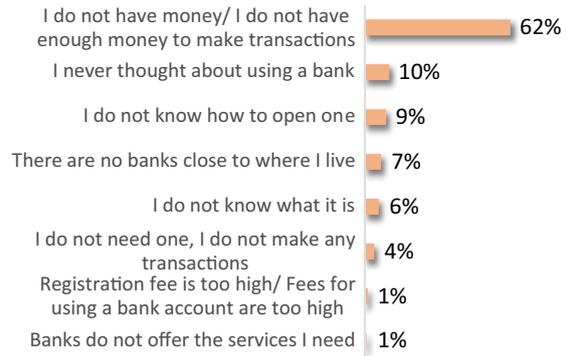
Sample: Smallholder farmers, n=2,771

This perception will influence any kind of adoption of accounts. Roughly two-fifths appreciated that a bank account would grant them the ability to save in a secure location and one-fifth said they can use a bank account to send or receive money from family or friends. Only 15 percent of smallholders did not know of any benefits to having an account.

Ten percent of smallholder farmers have a bank account registered in their name (Figure 89). An additional 2 percent use a bank account that belongs to someone else if they need to. Of those smallholder farmers who have a bank account registered in their name, roughly half have their accounts at Centenary Bank and nearly one-quarter have accounts at Stanbic Bank Uganda. Full-service banks can offer a range of services, including savings, money transfers, insurance, investments, and even sometimes loans. Nearly all smallholder farmers have or use accounts at full-service institutions.

For those smallholders who do not have a bank account, the main reason was lack of means (“I do not have money”). Interestingly, awareness (“I do not know what it is”), access (“no banks close to where

FIGURE 90. What is the main reason you do not have a bank account?



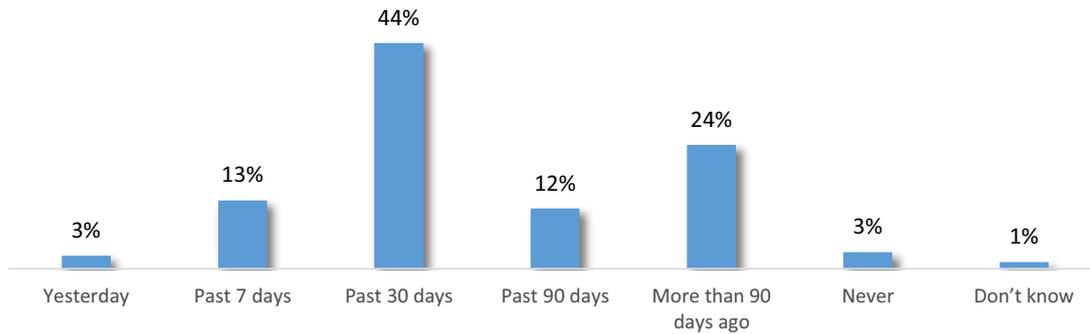
Sample: Smallholder farmers who don't have a bank account, n=2,415

I live”), and education (“I do not know how to open an account”) is a barrier for less than 10 percent, each, of smallholders (Figure 90). Out of 62 percent who say they do not have a bank account for lack of money, 54 percent are female and 76 percent are below poverty line.

Smallholders with bank accounts tend to use their accounts monthly or infrequently. Fewer than two in 10 had used their accounts in the seven days prior to taking part in the survey (Figure 91). There are two primary ways that smallholder farmers use bank accounts—either through an ATM or over the counter at a bank branch (Figure 92). When asked which was their preferred method, just over half of smallholder farmers said they prefer using an ATM and another 45 percent prefer going to a bank branch and banking over the counter (Figure 93).

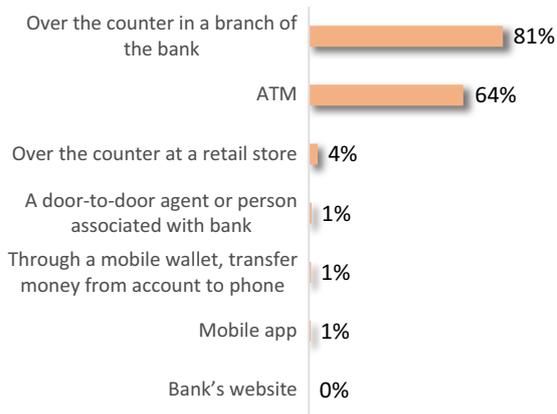
Three-quarters of smallholder farmers who have ever used a full-service bank do not use their accounts for business purposes (Figure 94). Only small percentages of Ugandan smallholders use their accounts for business, with the highest percentages using them for receiving payments from customers or making investments.

FIGURE 91. Apart from today, when was the last time you made a deposit or withdrawal using a bank account or used a bank account for any other financial activity?



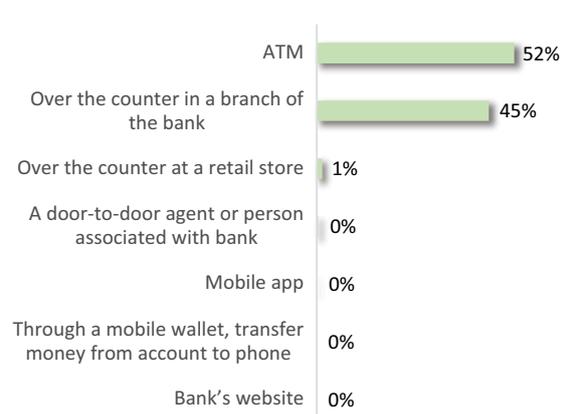
Sample: Smallholder farmers who have ever used a full-service bank for any financial activity

FIGURE 92. When you use a bank account for any financial activity, do you use any of the following?



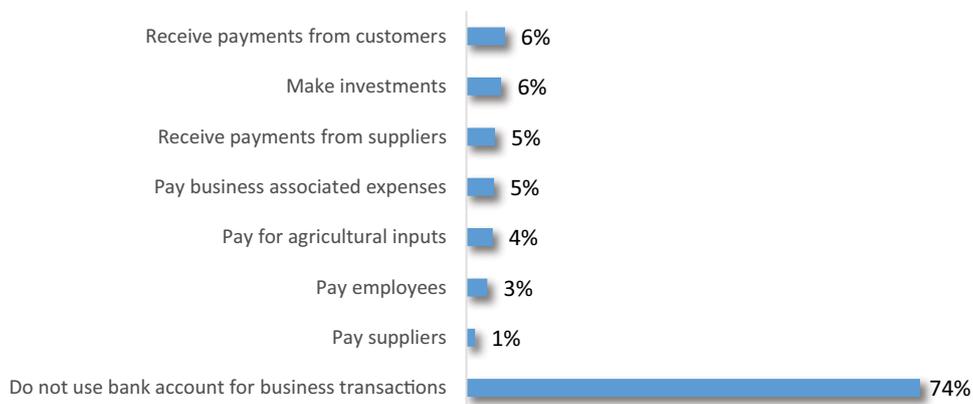
Sample: Smallholder farmers who have ever used a full-service bank for any financial activity, n=357
Multiple responses allowed

FIGURE 93. Of the different ways you use a bank for financial activities, which is your preferred way?



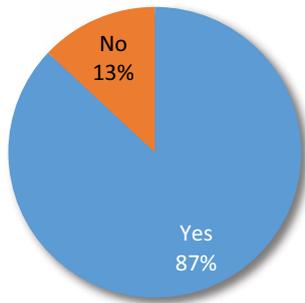
Sample: Smallholder farmers who have ever used a full-service bank for any financial activity, n=357

FIGURE 94. Do you use a bank account for the following payments or purchases?



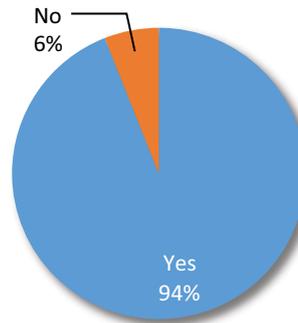
Sample: Smallholder farmers who have ever used a full-service bank for any financial activity, n=357

FIGURE 95. Have you ever heard of something called mobile money?



Sample: Smallholder farmers, n=2,771

FIGURE 96. Are there benefits to having a mobile money account?



Sample: Smallholder farmers who are aware of mobile money concept, n=2,411)

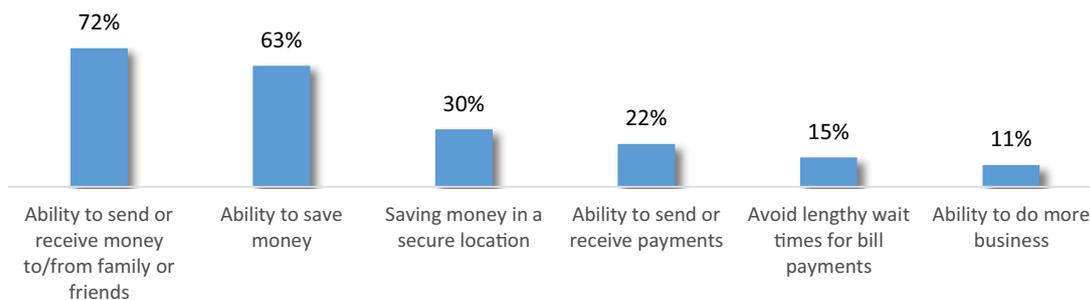
Financial inclusion: Mobile money awareness is very high, does not convert to use

Almost nine-tenths of smallholder farmers say they have heard of mobile money (Figure 95), and almost all smallholders see benefits to having a mobile money account (Figure 96). The benefits they cited most often included the ability to send or receive money to/from family or friends and the ability to save money (Figure 97). This widespread awareness and relevance does not translate into more specific product value. Less than one-third of smallholders think saving money in a secure location is a benefit of having a mobile money account. Conducting business via a mobile money account does not seem to register as a benefit, as it was one of the lowest-scoring applications for this financial mechanism.

Smallholder farmers in Uganda are aware of utilizing mobile money services for basic financial activities, with deposit and withdrawal at 78 percent and person-to-person money transfers at 49 percent. Smallholders are less aware of advanced uses of mobile money, with saving or storing at 34 percent and purchasing airtime at 31 percent (Figure 98).

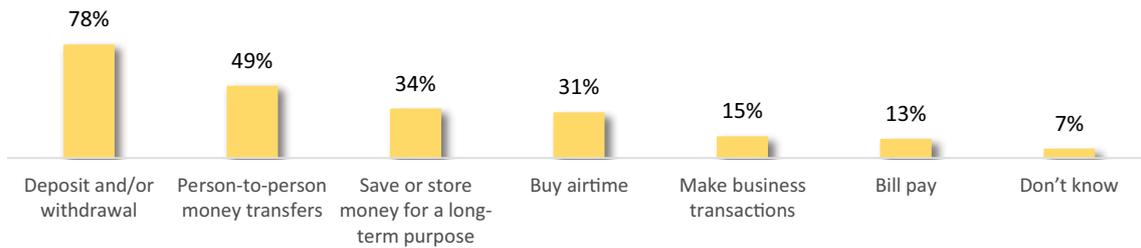
Overall awareness of mobile money providers is high for only two providers: MTN and Airtel. Nearly three-quarters named MTN unprompted and just under half named Airtel (Figure 99). The largest number of smallholder farmers became aware of these providers through the radio and a lesser number from friends or family members. All of the other providers were mentioned by less than 10 percent of all smallholder farmers, even those who were aware of the concept of mobile money.

FIGURE 97. What are the benefits to having a mobile money account?



Sample: Smallholder farmers who believe there are benefits to having a mobile money account, n=2,411
Multiple responses allowed

FIGURE 98. To the best of your knowledge, for what types of financial activities can you use mobile money?



Sample: Smallholder farmers who are aware of mobile money concept, n=2,272
Multiple responses allowed

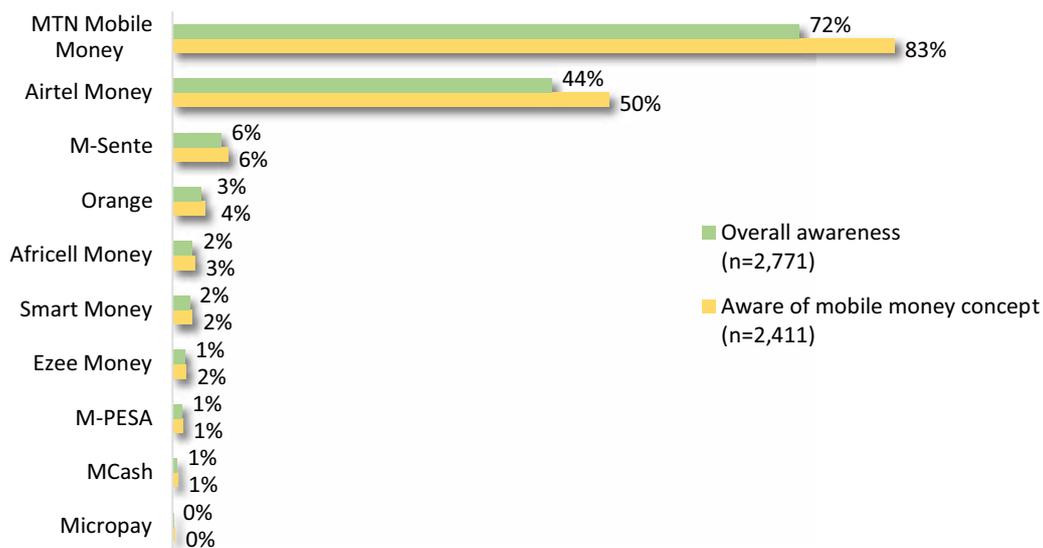
Just under one-third of smallholder farmers in Uganda have used mobile money in the past for a financial activity (Figure 100). Access to mobile money varies across the different demographic groups, with the highest number of users located in the Central region and in urban areas (Figure 101). Male smallholder farmers are more likely to have used mobile money than are females.

The main reasons for starting to use mobile money is to receive money from another person followed by the need to send money to another person (Figure 102). Starting to use mobile

money for saving purposes (“I wanted to start saving with a mobile money account”) or because of a word-of-mouth recommendation (“A friend or family member recommended it”) reflect a small minority of users. The main reason for never having used mobile money is a lack of finances (Figure 103). Just under half of nonusers said they “never have enough money to make transactions with this service.”

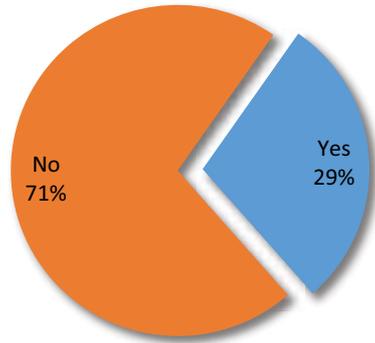
There is a slight drop off from users of the mobile money service to actual accounts; only 21 percent of smallholder farmers in Uganda report having a

FIGURE 99. Please tell me the names of any mobile money providers that you are aware of?



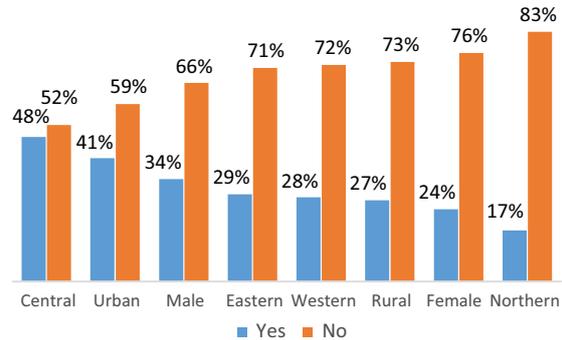
By overall awareness and awareness of mobile money concept
Sample: Smallholder farmers
Multiple responses allowed

FIGURE 100. Have you ever used a mobile money provider for any financial activity?



Sample: Smallholder farmers, n=2,771

FIGURE 101. Have you ever used a mobile money provider for any financial activity?



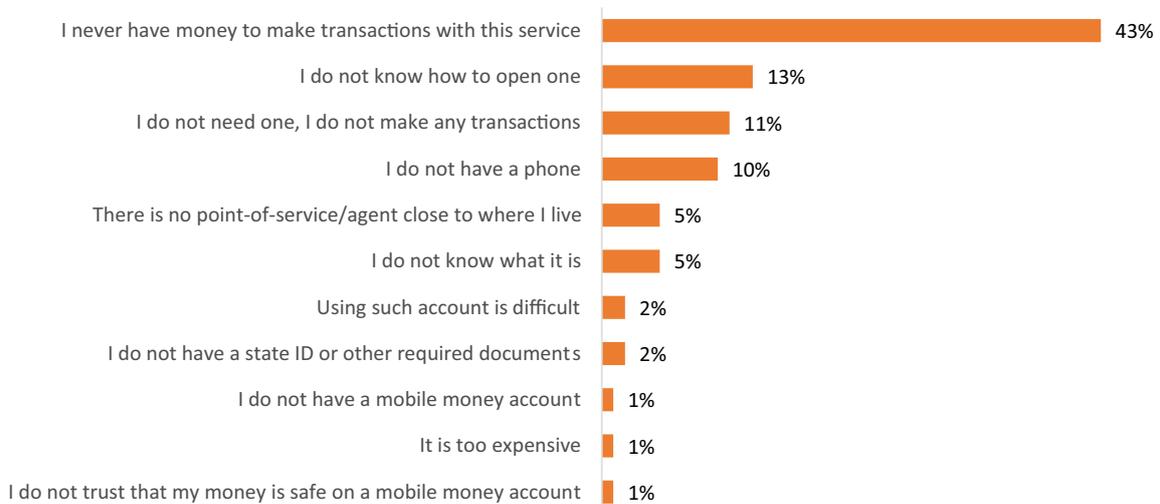
By region, urban/rural, and gender
Sample: Smallholder farmers, n=2,771

FIGURE 102. What is the main reason you started using mobile money?

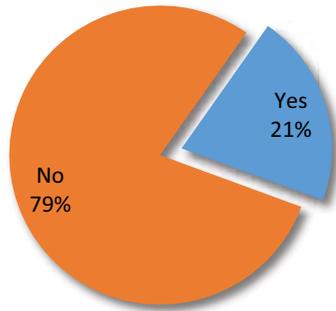


Sample: Smallholder farmers, n=888

FIGURE 103. What is the main reason you have never used mobile money services?



Sample: Smallholder farmers, n=602

FIGURE 104. Do you have a registered account with a mobile money provider?

Sample: Smallholder farmers, n=2,771

registered account with a mobile money provider (Figure 104). Similar to those who have used mobile money, the highest number of account holders are concentrated in the Central region and in urban areas (Figure 105). The lowest concentrations for mobile money account holders are female smallholder farmers and those that live in the Northern region of the country.

Financial inclusion: Smallholder farmers are not using nonbank or informal financial institutions

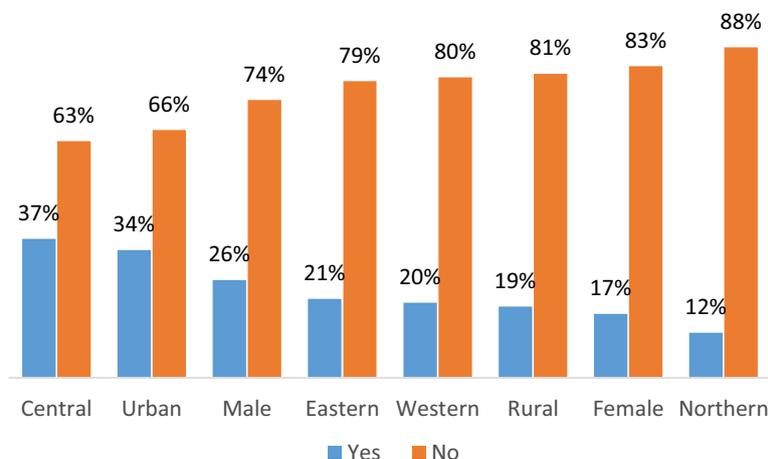
It can be rationalized that low bank participation stems from distances to banks, due to farmers located in rural areas; requirements that do not suit the

smallholder; or simply lack of knowledge about options.

Seemingly, these barriers to formal financial institutions could make way for the nonbank financial channels, such as microfinance institutions, cooperatives, or savings and credit cooperative organizations (SACCO), to be very popular alternatives in rural areas.

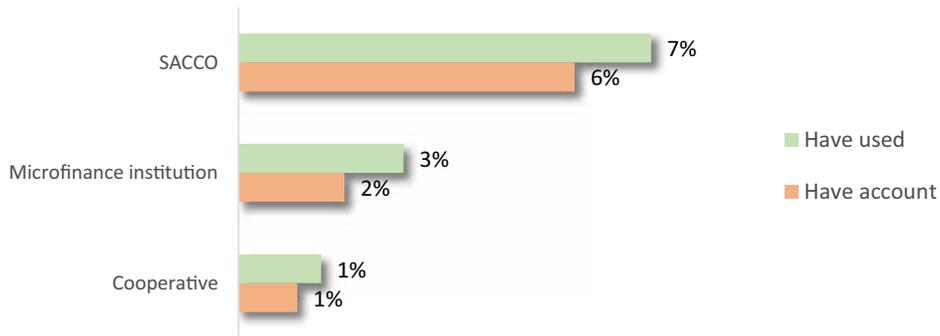
Smallholder farmers in Uganda, however, are not turning to other nonbank financial institution options. The highest use number for these types of institutions is at 7 percent for SACCOs, and account ownership is even less (Figure 106).

Informal financial service providers are used at a higher rate than nonbank financial institutions, with the highest numbers saying they have used a VSLA—village savings and loan association (Figure 107). Over one-tenth of smallholders have used shop keepers or rotating savings and credit associations (ROSCA). The smallholder farmers who use these providers do so on a somewhat regular basis; about half said they have used VSLAs and ROSCAs in the past week, and over four-fifths visited their shop keepers in that time (Figure 108).

FIGURE 105. Do you have a registered account with a mobile money provider?

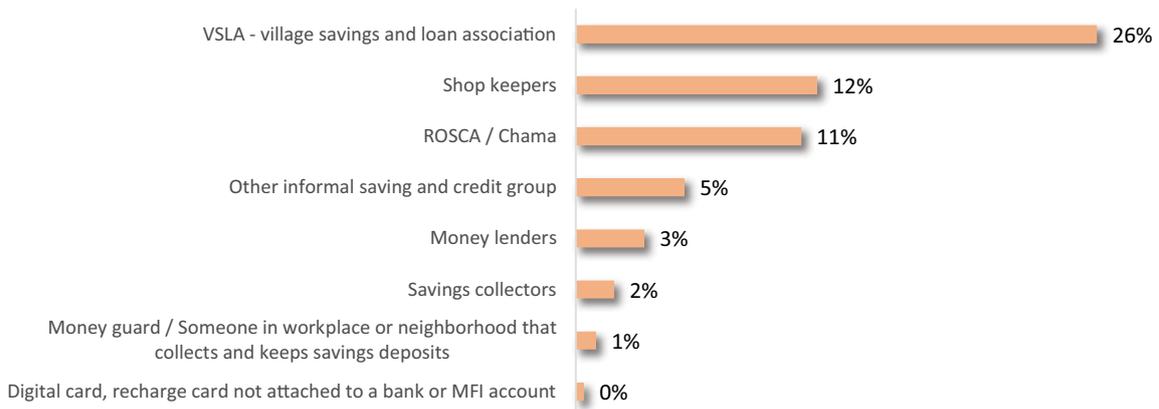
By region, urban/rural, and gender
Sample: Smallholder farmers, n=2,771

FIGURE 106. Have you ever used any of the following? Do you have an account/ membership in your name with any of the following?



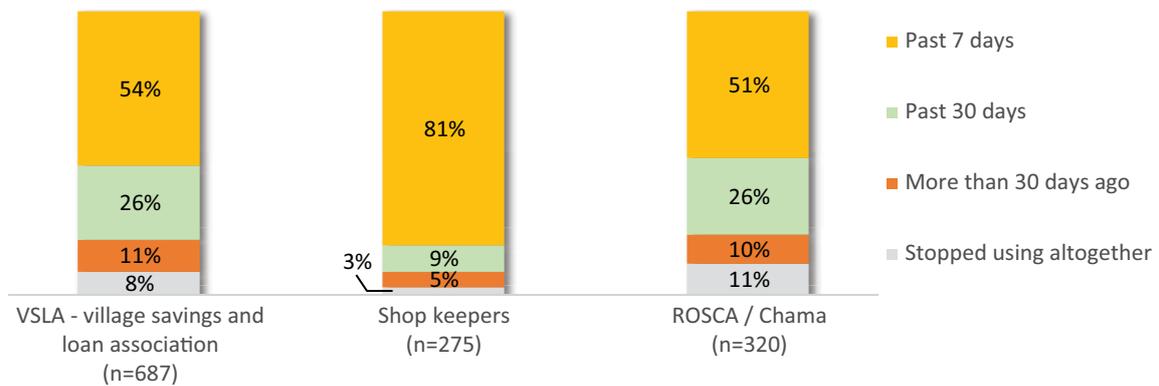
Sample: Smallholder farmers, n=2,771

FIGURE 107. Have you ever used any of the following?



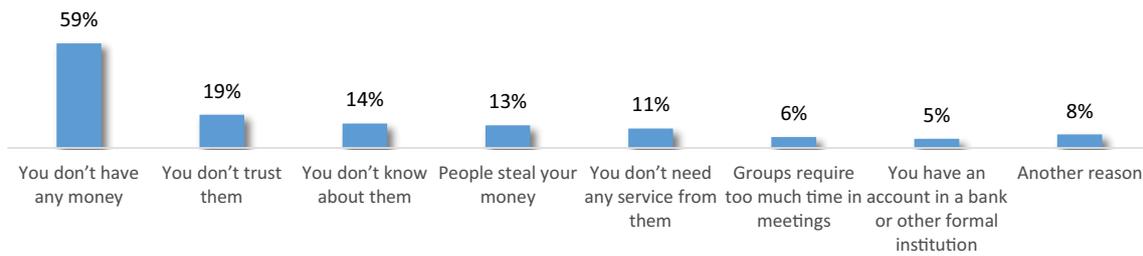
Sample: Smallholder farmers, n=2,771

FIGURE 108. Apart from today when was the last time you used these services or service providers for any financial activity?



Sample: Smallholder farmers, n=2,771

FIGURE 109. Why do you not have a membership with any of these groups?



Sample: Smallholder farmers who do not have any membership with an informal financial service provider, n=1,509
Multiple responses allowed

The main reason smallholder farmers do not have membership with any informal financial service institution is mostly financial (Figure 109). More than half of smallholder farmers do not have any money to have a membership; about one-fifth say they do not trust these groups.

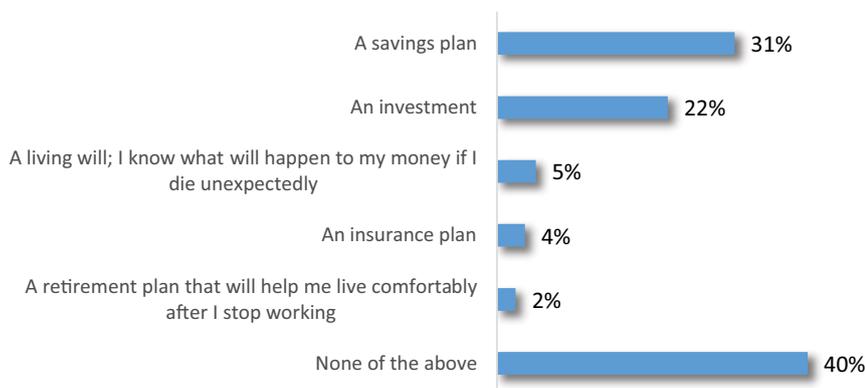
Some traction for financial planning products

Use of living wills, insurance, or retirement plans is very contained, with no more than 5 percent of farmers using any one of these. Savings plans and investments, however, are slightly more

common among farmers, with approximately one-third and one-quarter, respectively, having them. Only two-fifths of smallholder farmers do not have any type of financial product for future planning (Figure 110), though they value it.

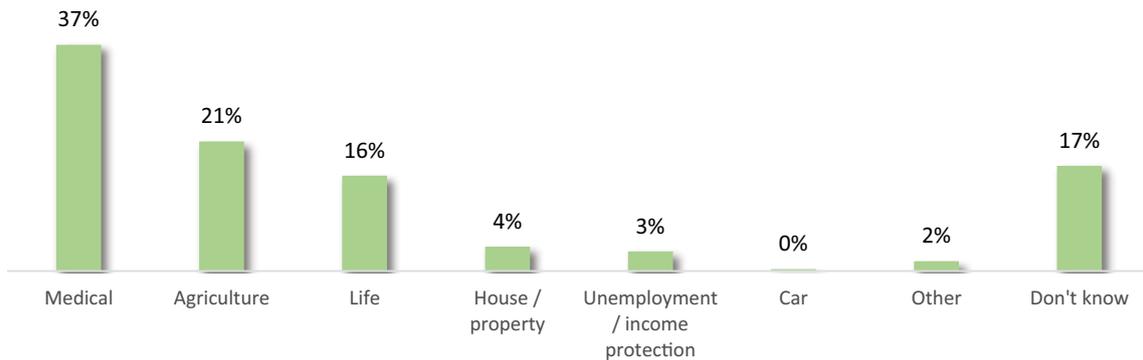
Among the 4 percent who have insurance, medical and life insurance are most common. Measured against the full sample, this only constitutes approximately 1 percent of smallholder farmers. Despite this, a majority of smallholders believe their household needs insurance. The top three types of insurance cited as the most needed were medical, agricultural, and life (Figure 111).

FIGURE 110. Do you have any of the following?



Sample: Smallholder farmers, n=2,771
Multiple responses allowed

FIGURE 111. Which of the following types of insurance do you feel your household needs the most?



Sample: Smallholder farmers, n=2,771

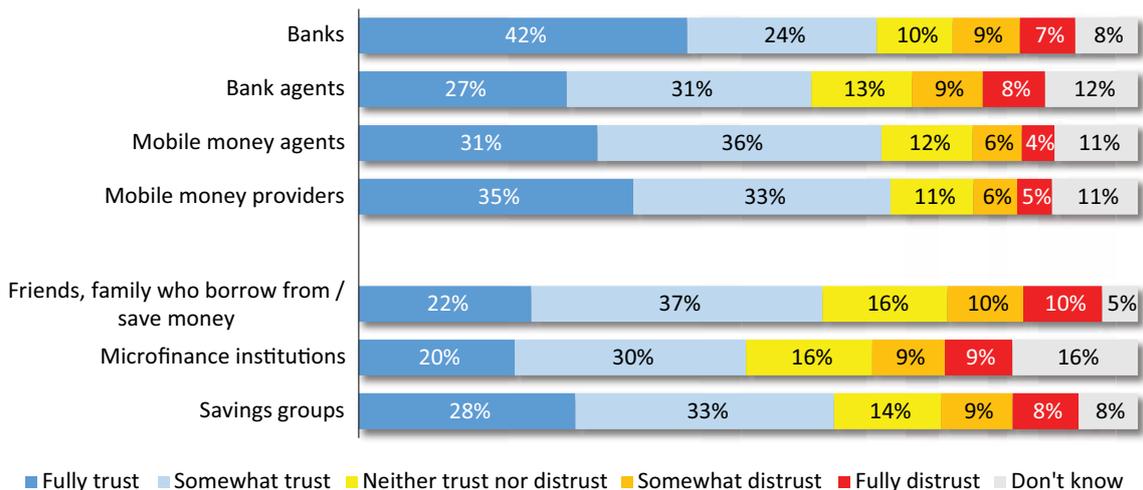
Financial inclusion: High amount of trust in banks and mobile money highlights an opportunity

Ugandan smallholder farmers have limited exposure to some financial service providers, but they nevertheless have a high perceived relevance. With that, they also show relatively high trust for these entities, which can present

an opportunity for banks and mobile money providers.

For instance, roughly two-thirds of smallholders trust banks, bank agents, mobile money providers or their agents, at least somewhat (Figure 112). This moderately high level of trust is a solid foundation that can build smallholders towards inclusion if providers can capitalize on it.

FIGURE 112. How much do you trust each of the following as financial sources?



Sample: Smallholder farmers, n=2,771

6. TOOLS AND FINANCIAL INCLUSION: SEGMENTATION— UGANDA'S FIVE UNIQUE SMALLHOLDER FARMING HOUSEHOLD SEGMENTS

The Segmentation Technique

Often a collection of demographic, psychographic, behavioral and attitudinal dimensions can characterize unique groups within an overall population, more so than any single factor or variable. The CGAP National Survey and Segmentation of Smallholder Households in Uganda anticipated the complexity of smallholder households, expecting there would be unique personas within the broader population.²⁸ To that end, it sought to explore those key dimensions that underlie different groups of smallholder households using a segmentation analysis.

Segmentation is a form of statistical multivariate analysis that groups people based on their psychographics,²⁹ attitudes, expectations or behaviors with respect to their own household dynamics. The groups, also referred to as clusters, that emerge from the analysis ultimately allow us to deepen our understanding of how various characteristics drive financial inclusion. Classifying smallholder households by key attitudinal and behavioral characteristics provided a better understanding of the population and the challenges on the path to financial inclusion.

The segmentation process uncovered various underlying structures that delineated groups of people. This clustering technique looked for homogenous groups that exist within the population sample examined. It did not create these groups. Rather, the technique identified groups through analysis of the responses given by each respondent to various

questions, examining how respondents in the sample are similar to each other and how they differ from one another.

Truly effective segmentation analyses are rooted in dimensions that lead to a common, desired and shared goal for the population overall. This allows a segmentation analysis to be more germane and better targeted, therefore, more useful for interested parties. In the case of the smallholder households in Uganda, the common, shared goal is building strategies for bringing about more useful, reliable, trusted, consumer-focused financial services (formal or informal) both connected to agriculture and that meet the wide range of other household needs. Therefore, this segmentation is rooted in defining elements that correlate with greater formal financial inclusion.

Looking beyond the initial analysis, this segmentation can be repeated in follow-up or tangential studies, where the discerning indicators that define the unique segments are included to create the same groups within the target audience. For instance, an organization bringing a financial mechanism to market can use these segments to do the following:

- Identify which segment poses the most potential for the organization and its intentions.
- Customize type of mechanism based upon the needs of a desired segment.
- Fine-tune application and go-to market strategy based on market readiness of the segment.

²⁸ Personas as profiles that create reliable and realistic representations of key audience segments for reference.

²⁹ Psychographics refer to behaviors, interests, activities and acquisitions of a population, together with demographics and other attitudinal factors.

- Optimize market positioning of the mechanism to capture a specific segment of the population.
- Level-set expectations for uptake and use based on the size of the desired segment.
- Track impact of mechanism within the most relevant and intended segment.

Phases of the smallholder household³⁰ segmentation

Predicting corollary values

The first phase of the segmentation analysis involved a machine learning algorithm called Random Forest³¹ that assessed the individual factors that most correlate with formal financial account ownership (mobile money, bank, NBF) (Annex 2). The six most predictable and discerning measures of financial account ownership are as follows:

1. Educational attainment of the head of household.
2. Socio-economic status or PPI of head of household.
3. Access to emergency funds.
4. Mobile phone ownership.
5. Attitude toward the future.
6. Encountering unexpected life and farming events.

These measures emerged as the most discerning after extensive tests and modeling which took into consideration more than 30 demographic, psychographic and farmographic (size of land, type of crops, value chains, inputs used, cash crops, consumption crops, etc.) variables collected

by the surveys. The model showed that listed variables (Figure 113) correlated the most with the tendency to have a formal financial account.

None of the farm or land-specific questions correlated with formal financial account ownership (mobile money, bank, NBF) with enough relative strength to be considered part of the model.

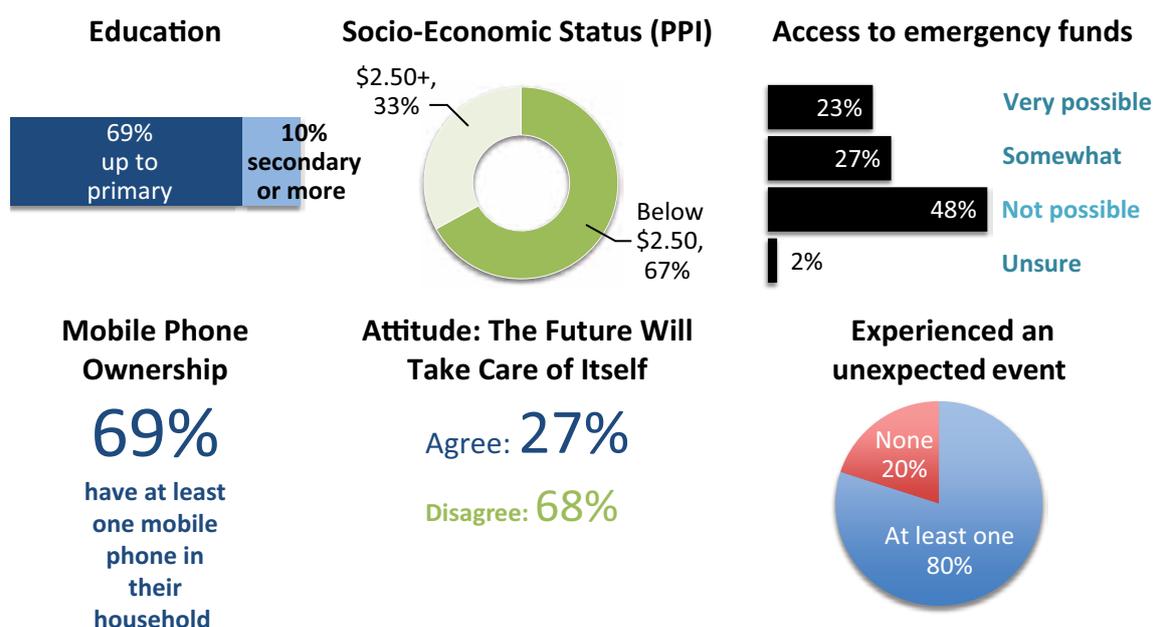
At first, this seemed perplexing, knowing that agriculture is central to smallholder households. Further exploration suggested that the relative homogeneity of farming activities in Uganda, limited value chain and digital ecosystem, as well as the limited, contained ownership of formal accounts was in fact manifesting itself in the modeling. For instance, the number of crops or tendency to sell versus consume them are not the factors that drive smallholders to have a financial account. In an ecosystem where payments were digital, or loans were more formal, you might see some more direct correlations. Here, correlations manifest themselves through socioeconomic elements including education, PPI, access to funds, phone ownership, and other experiences or attitudes.

Forming Segments

The second phase of the segmentation analysis was to explore the degree to which these factors together explained the variation within the population, and formed meaningful cleavages within it, carving out distinct personas. Individually, these measures are the strongest predictors of financial inclusion, and useful in helping determine the likelihood of becoming part of the financial fold. Compiled together in a segmentation model, these factors cause

³⁰ The segmentation analysis is based off of a three-part survey, which gathered information from all aspects of the smallholder farmer—the household, all household members who contribute to the income of the household, and a randomly selected household member. The term “smallholder household” is used throughout this report to refer to the sampled population, which draws information from the head of household or a randomly selected household member.

³¹ See Annex 2 and <http://www.statsoft.com/Textbook/Random-Forest> for documentation on the Random Forest Algorithm.

FIGURE 113. Uganda Smallholder Farmers

(Sample: All Smallholder Farmers)

meaningful divisions that enable greater understanding of the population and can facilitate targeted strategies for moving the group to the end goal.

Using the most predictive variables identified in the Random Forest³² exercise, the clustering analysis produced a five-segment solution, delineating five unique segments of smallholder households:

1. “Farming for sustenance”
2. “Battling the elements”
3. “Diversified and pragmatic”
4. “Options for growth”
5. “Strategic agricultural entrepreneurship”

Since the sample was randomly selected and represents the population of smallholder farmers and households across Uganda, we can reasonably assert the five segments represent natural groups in the population as a whole. We also expect that similar groups exist in

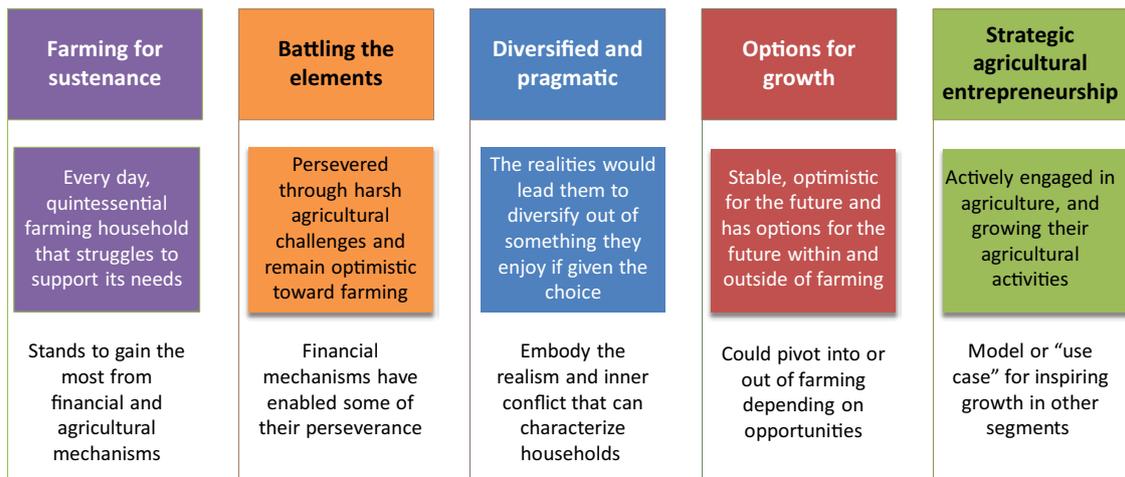
smallholder farming populations outside of Uganda, though the description and the incidence of each reported herein is unique to Uganda.

By segmentation variables only, the five clusters or segments are as follows:

1. **Farming for sustenance:** The “farming for sustenance” segment represents the quintessential Ugandan farming household. The segment indexes low on the Progress out of Poverty Index, has been farming for many years, and is the highest in wanting their children to continue farming. This segment has the lowest household income of all five, and truly does live off of what the farm produces, either consuming, selling or trading the fruits of their agricultural labor. This is a highly vulnerable group, and perhaps stands to gain the most from financial and agricultural mechanisms that can optimize their daily labor.
2. **Battling the elements:** The “battling the elements” segment is also a

³² See Annex 2 and <http://www.statsoft.com/Textbook/Random-Forest> for documentation on the Random Forest Algorithm.

AQ2

FIGURE 114. Uganda Smallholder Household Segments

vulnerable group, but as a group, does not face the income limitations of those “farming for sustenance.” A greater portion of this group, compared with the “farming for sustenance” group, generates income from agriculture, and a greater portion of these households has multiple income sources. This segment is still challenged by somewhat limited education and the incidence of unexpected life or farm-related events, such as weather challenges or illnesses in the family. Experience with negative farm events (e.g., pests and diseases) is the highest for this group. Challenges have not dampened their future aspirations or dissuaded them from working hard. This group has persevered through those challenges, sometimes using financial tools, making them a group that might better understand the value of having some form of a safety net. The biggest difference between this group versus the “farming for sustenance” segment is the first group has a more limited education and experiences more negative agricultural events.

3. **Diversified and pragmatic:** The “diversified and pragmatic” segment reflects the realism and inner conflict that can characterize smallholder farming households. These households grow more, sell more,

earn more, have more income streams and have more connectivity to financial mechanisms. In some ways, they have an aspirational profile like “farming for sustenance” and “battling the elements.” They have suffered unexpected life events to a similar level as other segments, and have had resources to overcome what they do experience. The conflict that arises in this group is that, despite enjoying farming, taking pride in it, and looking for opportunities to grow their farms, many would diversify out of agriculture if given the opportunity, potentially out of frustration with the realities of farming. They are thoughtful about what they do, but can also be impulsive, looking for opportunities to improve their situation. This is an important group as they represent smallholder households that have diversified within and outside of agriculture to best sustain their household needs.

4. **Options for growth:** The “options for growth” group earns a higher income, has more resources for when the unexpected occurs, and is even optimistic about their future. Their future, though, could take them in one of two directions, within or outside of agriculture. This diversification appears deliberate, so that a household has options to take care

of itself if their agricultural yield becomes too difficult to maintain. While the segment relies heavily on agricultural income, it is also the most likely to be engaged in more stable income sources outside of agriculture. They are equally as passionate about farming, continuity in agriculture, and satisfaction with farming as they are embracing of opportunities outside of the agricultural sector. The youngest of all groups, this segment could pivot in either direction depending in part on how they are cultivated by policymakers, development organizations and financial institutions.

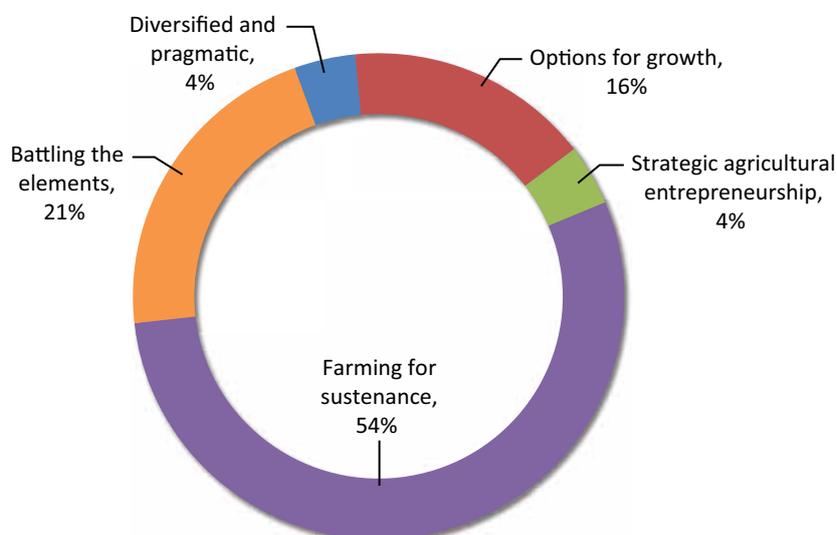
5. **Strategic agricultural entrepreneurship:** The “strategic agricultural entrepreneurship” segment includes households that appear to be actively engaged in building their agricultural work with some indications of success or at least progress. The group is more enabled than others, having higher income, greater access to emergency funds, and more financial mechanisms at their disposal. This group of smallholders has been impacted by the realities and challenges of farming, and have been able to rely upon their savings or other

resources to get them through tough times. What characterizes them more definitively, though, is their mindset. The smallholders in this segment put much thought into what they do and has big aspirations that include a future in agriculture. Farming is what they want to do, what satisfies them, and where their legacies live. They are not as likely to want out, or be willing to take work outside of agriculture. This is a group that can be a model or a use-case for carrying meaningful messages or examples for growth to other segments of the population.

There is greater definition and characterization of these segments when we explore more deeply how they behave, what they believe, and where their interests lie.

As a whole, these five segments behaviorally characterize smallholder households across Uganda. The “farming for sustenance” group is the most predominant in the country, comprising 54 percent of farming households. They differ slightly from the next largest group, “battling the elements,” comprising 21 percent (Figure 115). The remaining 24 percent include the “diversified and pragmatic,” “strategic agricultural entrepreneurship,” and the “options

FIGURE 115. Uganda Smallholder Household Segments



(Shown: All smallholder farmers)

TABLE 13. Uganda Smallholder Household Segments by Clustering Criteria

Segment= n=	Farming for sustenance 1,324	Battling the elements 574	Diversified and pragmatic 144	Options for growth 569	Strategic agricultural entrepreneurship 160
Educational attainment of household head					
Never attended school	25%	15%	19%	5%	12%
Preprimary	52%	57%	63%	10%	39%
Primary	17%	24%	14%	43%	39%
Secondary	5%	4%	3%	33%	8%
Higher education	1%	0%	1%	8%	1%
Socioeconomic status					
Above the poverty line	14%	20%	100%	62%	100%
Below the poverty line	86%	80%	0%	38%	0%
Access to emergency funds: Can come up with 114,000 shillings within the next month					
Very possible	12%	29%	0%	42%	73%
Somewhat possible	22%	32%	60%	31%	17%
Not possible	63%	37%	38%	26%	9%
Don't know	3%	2%	1%	1%	0%
Mobile phone ownership					
No	50%	1%	2%	1%	0%
Yes	50%	99%	98%	99%	100%
Attitude: The future will take care of itself					
Agree	32%	23%	17%	21%	16%
Disagree	62%	72%	73%	78%	79%
Don't know	6%	4%	10%	1%	5%
In the past 12 months, experienced any unexpected events (including, but not limited to death, illness, accidents, etc.).					
No, I didn't	22%	15%	14%	19%	15%
Yes, I did	78%	85%	86%	81%	85%

(Shown: All smallholder farmers)

for growth” segments, who represent a small, but important, component of the farming population.

Table 13 shows each segment and how it fares on each of the cluster-defining variables: education, socioeconomic status, access to emergency funds, mobile phone

ownership, attitude toward the future and experience with unexpected events.

The profiles below detail the dynamics of each segment, bringing character and depth to each of them.³³ Perhaps the best illustration of the differences in the segments, however, is the linear

³³ Caution: Small segment sizes for the “diversified and pragmatic” and the “strategic agricultural entrepreneurship” groups can limit analysis. Proceed with caution in extrapolating findings.

progression of the five groups, where the “farming for sustenance” (and largest group) is the most impoverished and in need, and the “options for growth” are at the far other end showing models of progress within the population.

Segment 1: “Farming for sustenance”: Dependent on the farm for day-to-day survival

The “farming for sustenance” segment is the predominant segment among smallholder households in Uganda. Comprising 54 percent of farming households, it is a sizable segment, containing the majority, and, therefore, the “status quo” for farming households in the country.

Segmentation analysis typically clusters a population in smaller groups beneath the 50 percent mark. In the case of Uganda, there is a preponderance of vulnerability due to a host of factors that include education, resources and income that cannot be ignored, hidden, or even further segmented into anything meaningful when it comes to predicting financial inclusion. That alone tells us that acknowledging the income vulnerability and other unique aspects of this population will be critical to bringing financial mechanisms to scale in the country. Making it even more critical is the fact that no other single or group of segments come close to the size of this segment.

Characterizing attributes: comparisons to other segments

The “farming for sustenance” group tends to be older (only 36 percent are under 39 years old) but is as tenured in farming as most other segments (58 percent, 10+ years in farming). They are less satisfied with their farming achievements (58 percent “satisfied”), yet still enjoy working in agriculture (91 percent), and intend to keep working in it (88 percent). Nearly half (47 percent) say they would not want to do any other kind of work.

Demographics: Nearly all smallholder households in this segment live in poverty, are concentrated in the Northern and Eastern regions of the country, and largely headed by older farmers.

Relative to other segments, the “farming for sustenance” segment skews older, with an unequal distribution across age groups. Only 14 percent of the “farming for sustenance” segment is between 15 and 29, leaving the balance spread across 30 and over. Households are concentrated in the Eastern and Northern regions with the greatest concentration in the East at just over one-third (36 percent), followed by 30 percent in the North.

Nearly all, 87 percent, live under the poverty line.

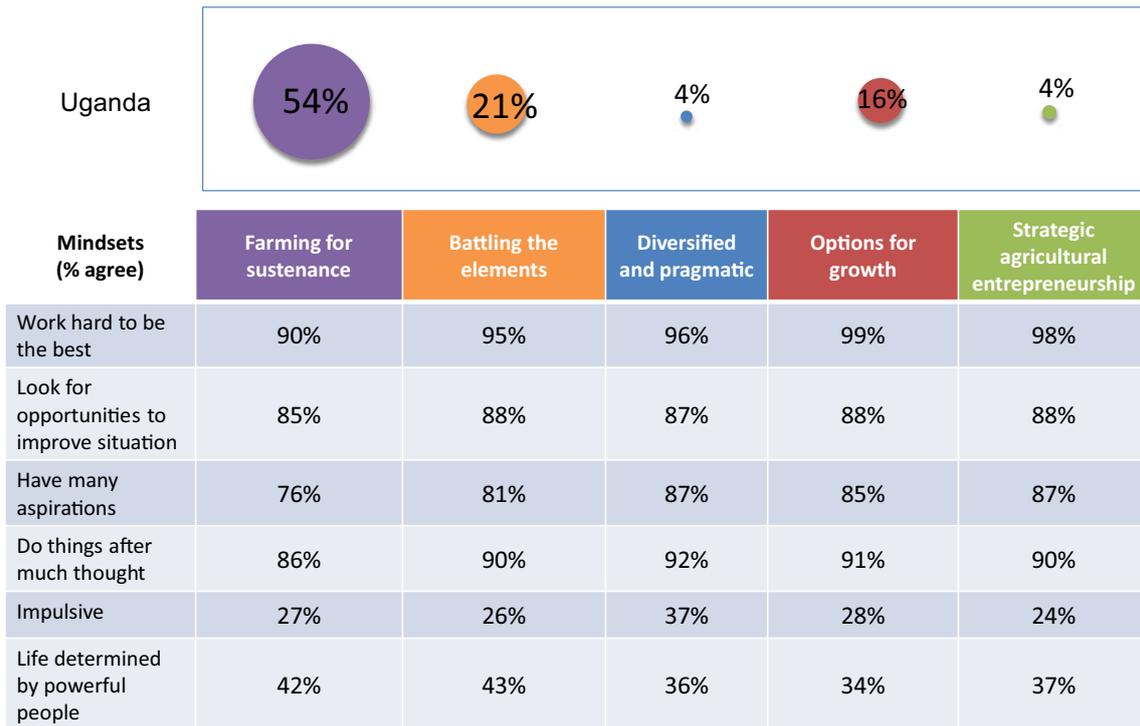
SEGMENT SYNOPSIS

Representing the quintessential Ugandan farming household, the “farming for sustenance” segment indexes very low on the Progress out of Poverty Index, shows a high number of years in farming, and generally wants their children to continue farming.

This segment truly does live off of what the farm produces, either consuming, selling or trading the fruits of their agricultural labor, without much else to sustain their households.

This is a highly vulnerable group, and perhaps stands to gain the most from financial and agricultural mechanisms that can facilitate their daily labor.

AQ2 **FIGURE 116. Uganda Smallholder Household Segment Mindset**



(Shown: All smallholder farmers)

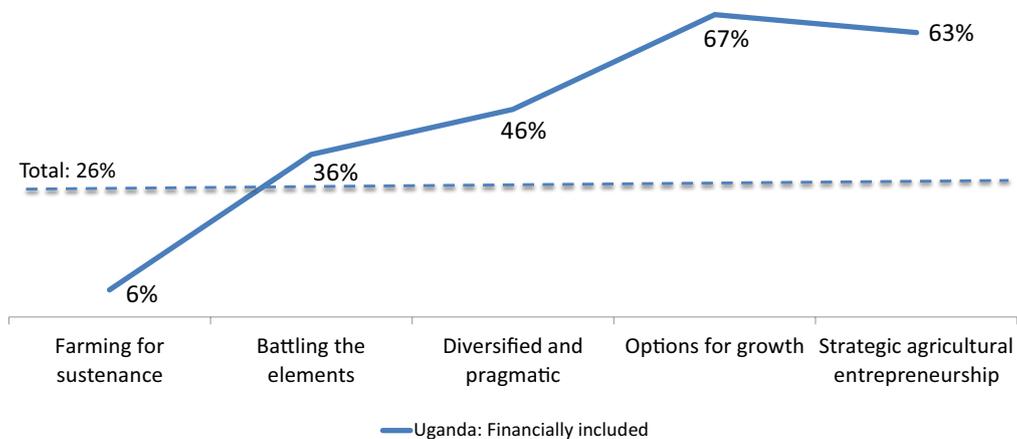
Farming: Experience, income and crops

“Farming for sustenance” households are tenured in their craft. Fifty-eight percent have been working in agriculture for more than 10 years. An additional 16 percent have been part of agriculture for six to 10 years. Only 25 percent

are newer to agriculture, working in it under five years.

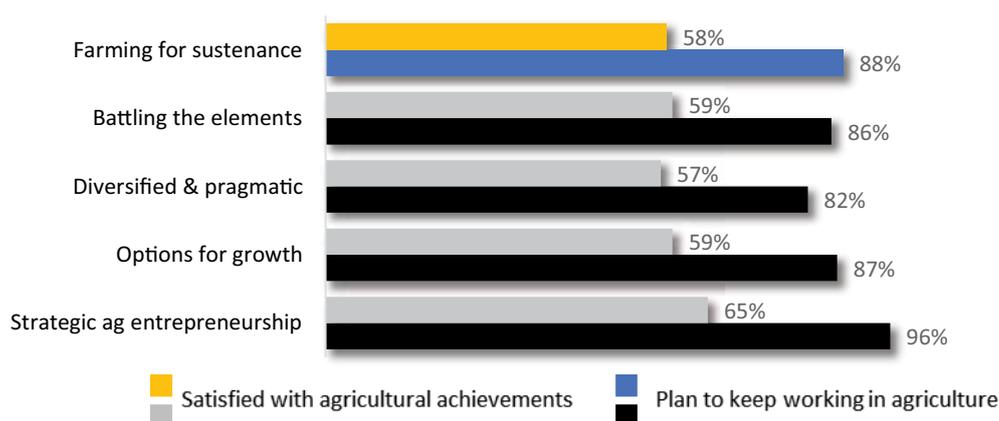
These households mostly intend to continue working in agriculture (88 percent). They generally enjoy it (91 percent), and many would like to expand their capabilities (85 percent). That said, it is fair to point out that full-time employment

AQ2 **FIGURE 117. Smallholder Farmers in Uganda Financial Inclusion* by Segment**



(Shown: All smallholder farmers)

* Financial Inclusion defined as having a full-service bank, mobile money or nonbank financial institution account with access in one’s own name.

FIGURE 118. View of success in agriculture vs. willingness to continue working in it

Sample: All smallholder households who participate in agricultural activities by segment

could also be attractive to smallholder households in this segment (66 percent). That fewer than six in 10 (58 percent) farmers in this segment are satisfied with what their agricultural work has achieved (Figure 118) suggests they are critical of themselves, and perhaps wanted better outcomes than their circumstances could support.

Ninety-one percent of “farming for sustenance” households generate income from agriculture and, overall, these households tend to have fewer sources of income (30 percent, one source of income; 34 percent, two sources of income). Close to one-fifth of the segment generates income from occasional jobs, and 9 percent generates income from retail or manufacturing. Only five percent receive salary and wages from a regular job.

Collective reporting from all household members active in agriculture shows that two-thirds of the households in “farming for sustenance” have two hectares of land or less. Up to an additional 13 percent have between two and

three hectares, and the rest have over three hectares of land.³⁴

On average, the smallholder households in the “farming for sustenance” segment are growing seven crops (6.93 precisely) each year on their land. They tend to sell on average four of the crops they grow (3.57 precisely).

Vulnerable to outside elements

Their vulnerability becomes even more apparent when comparing the percentage generating income from agriculture against the percentage whose agricultural events have been seriously affected by an outside element. Nearly all smallholders in this group (98 percent) were impacted by weather, pests and disease, accidents, market fluctuations, equipment failure and/or their own health issues. Seventy-four percent were affected by more than one issue and 85 percent were affected by weather, while 73 percent faced pests and disease.

Among those who were seriously affected by any of the above events, over

³⁴ The land size measurement comes from the household survey where multiple members of the agricultural household offer up their recollection of various dynamics so as to capture full dynamics instead of relying upon just one member’s knowledge of the household. An aggregate estimate of this measure was then created and appended to the segmentation, which is based on participant responses to the individual questionnaire (asked of just one randomly selected household member). These data are weighted accordingly. Use data with caution surrounding extrapolation and inferences. These should be used only as added descriptive measures.

three-fifths (63 percent) of affected farming households did nothing. For those who did take action when coping with unexpected events:

- Only 3 percent coped by taking a temporary job
- 5 percent sold an asset
- 2 percent took a loan and 10 percent borrowed
- 11 percent sold livestock or crops
- 14 percent used savings

Financial attitudes

The segmentation model is built on predictors of financial inclusion, which is defined here as those having a full-service bank, mobile money or NBFi account in their name. It follows, then, that ordering segments from more vulnerable “farming for sustenance” and “battling the elements” groups to “strategic agricultural entrepreneurship” shows a somewhat linear relationship with financial inclusion.

Extremely limited access to financial services

Overall, 26 percent of Ugandan smallholder households are financially included, meaning they have a full-service bank, mobile money, or NBFi account in their name. The “farming for sustenance” segment comes in lowest, with only 6 percent being financially included. Since this segment is the largest, encapsulating 54 percent of the smallholder households in the country, it is, therefore, a driving force behind the overall financial inclusion number for smallholder farmers in Uganda.

Mobile money accounts are the most popular formal financial service among the “farming for sustenance” segment. That said, only 3 percent have a mobile

money account. Overall, 11 percent can access mobile money either through their own or through someone else’s account. Seventy-six percent of “farming for sustenance” had heard of mobile money prior to the survey, compared to at least 90 percent awareness among other segments.

Three percent of “farming for sustenance” smallholders have an NBFi account but just 4 percent have used an NBFi. Three percent of the smallholder households in the “farming for sustenance” segment reported having used a bank and just 2 percent have an account. Fifteen percent had ever been inside a bank.

While more prevalent than formal financial services, still only two-fifths (42 percent) of the “farming for sustenance” segment has access to an informal financial mechanism such as a savings or loan association or ROSCA, moneylender or money guard. Twenty-two percent of those in this segment have used a village savings and loan association and 10 percent have used a ROSCA. Three percent have used a moneylender, and 1 percent have used a money guard or someone who collects savings deposits.

Lower perceived importance of financial practices versus other groups

Separate from having financial mechanisms, there is also a gap in perceived importance of financial behaviors, such as savings. Large majorities of this segment feel it is very important to save for future purchases (82 percent) or school fees (74 percent), and more than two-thirds find it important to save for the unexpected (69 percent) or regular purchases (64 percent).

There also is a strong sense of importance of investing in the farm

FIGURE 119. View saving money through different mediums as “very important”

Sample: “Farming for sustenance” households, n=1,324

(80 percent very important), though this is muted relative to other segments. Members of this segment do not perceive as much importance in saving through financial mechanisms, formal or informal, or even in the home (Figure 119).

Segment 2: “Battling the elements”: Challenged, with limited resources but persevere

The “battling the elements” group is the second largest segment in Uganda, comprising 21 percent of smallholder farming households. The size of this segment is more typical based on what

we expect to see when leveraging a five-segment solution. This is an important group because these households are facing many of the same limiting circumstances as those in the “farming for sustenance” group, but are more able to call on their support networks for financial assistance. They are taking better financial steps in their lives, despite having less education and facing the brutal realities of farming.

Characterizing attributes: comparisons to other segments

Unlike the “farming for sustenance” segment, this group tends to be younger

SEGMENT SYNOPSIS

The “battling the elements” segment is also a vulnerable group, but as a group, does not face the limitations of a support network like the “farming for sustenance” segment. A greater portion generate income from agriculture, and a greater portion of these households has multiple income sources. This segment is still challenged by limited education, and the incidence of unexpected life or farm-related events.

Experience with unexpected life events is somewhat greater for this group than the others. Challenges have not dampened their future aspirations or dissuaded them from working hard. This group has persevered through those challenges, sometimes using financial tools, which might make them the group that better understands the value of having some form of a safety net.

The biggest differences between this group and the “farming for sustenance” group, is that the “battling the elements” group experiences more unexpected life events but can call on a stronger financial support network.

(18 percent, <30) and more tenured in farming (66 percent, 10+ years). Many are satisfied with their agricultural achievements (59 percent), and generally enjoy (88 percent) and intend to continue working in agriculture (86 percent). There is some appeal to work outside of agriculture. Only 43 percent would not want to do any other kind of work, and 31 percent would not take another job if offered. Eighty-five percent of this segment lives under the poverty line. This is a smaller portion than in the “farming for sustenance” segment, but substantial nonetheless.

Demographics: A majority of smallholder households in this segment live in poverty, are concentrated in the eastern and western regions of the country, and represent a younger group of farmers.

Versus other segments, the “battling the elements” smallholders are one of the youngest. Roughly half (48 percent) are under the age of 40. Close to two-fifths (38 percent) live in the Western region of the country, and a nearly equal part (30 percent) live in the Eastern region. Nineteen percent come from the North. The vast majority, 85 percent, live under the poverty line.

Farming: Experience, income and crops

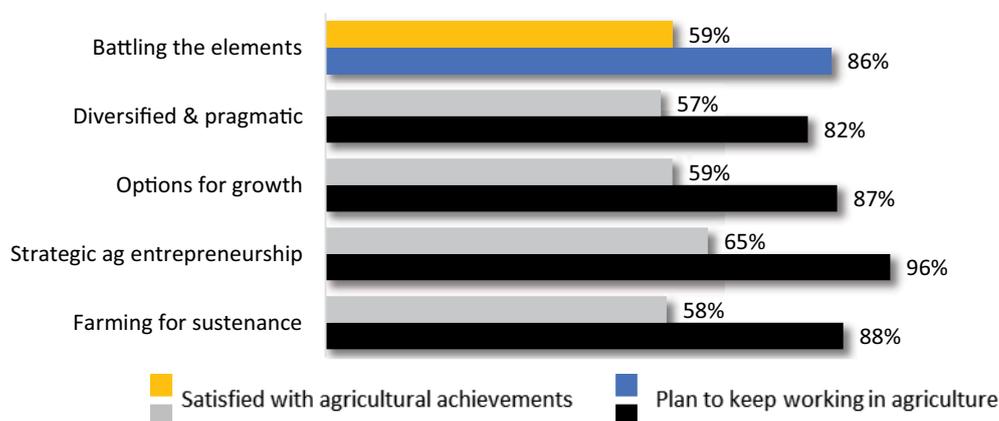
“Battling the elements” households are the most tenured in their craft. Two-thirds of those in this segment have been working in agriculture for more than 10 years. An additional 18 percent have been part of agriculture for six to 10 years. Only 15 percent are newer to agriculture, working in it five or fewer years.

Enjoyment of farming

These households mostly intend to continue working in agriculture (86 percent). They generally enjoy it (88 percent), and many would like to expand their capabilities (87 percent). Close to three-fifths are satisfied with their farming achievements (59 percent) (Figure 120). That said, it is worth noting that full-time employment also could be attractive to some households (65 percent).

Over nine-tenths (94 percent) of “battling the elements” households generate income from agriculture, and overall these households tend to have more sources of income (24 percent, one source of income; 35 percent, two sources of income; 29 percent, three sources of income; and 11 percent, between four and

FIGURE 120. View of success in agriculture vs. willingness to continue working in it



Sample: All smallholder households who participate in agricultural activities by segment

seven sources). This group, however, skews slightly higher in income sources than the “farming for sustenance” group. As with the “farming for sustenance” group, smaller percentages earn wages from occasional jobs (21 percent), and close to one-fifth (17 percent) run a business in retail or manufacturing. Only 7 percent get wages or salary from a regular job.

Roughly 66 percent of the smallholder farming households in “battling the elements” have two hectares of land or less. Up to an additional 17 percent have between two and three hectares, and the rest have over three hectares of land.³⁵

On average, the “battling the elements” households are growing seven crops (7.11 precisely) each year on their land. They tend to sell, on average, four crops they grow (3.61 precisely).

Vulnerable to weather

Their vulnerability becomes even more apparent when comparing the percentage generating income from agriculture against the percentages whose agricultural events have been seriously affected by an outside element (including weather, pests, illness, loss, accidents). Overall, nearly all of this group (97 percent) were impacted by weather, pests and disease, accidents, market fluctuations, equipment failure and/or their own health issues, and 75 percent faced two or more issues. Over three-quarters (78 percent) were affected by weather. Nearly as many (76 percent) faced pests and disease issues.

Among those that were seriously affected by any of the above events, roughly three-fifths (59 percent) of affected households did nothing. When facing unexpected events:

- 11 percent sold livestock or crops
- 16 percent used savings
- 4 percent coped by taking a temporary job
- 6 percent took a loan from a financial service provider and 9 percent borrowed from others
- 5 percent sold an asset

Financial attitudes

Compared with all of the other groups, the “battling the elements” segment comes in with the second lowest percentage of those who are financially included, meaning they have a full-service, bank, mobile money, or NBFi account in their name. Only 36 percent are financially included (versus 26 percent of Uganda smallholder households overall). This group is six times as likely to have formal financial mechanisms in place compared with the “farming for sustenance” group.

Some formal financial accounts

Here too, mobile money accounts are more prevalent among the financial mechanisms than NBFIs or banks. Twenty-nine percent of smallholders in this group have their own accounts, and 93 percent of the segment had heard of mobile money prior to the survey.

³⁵ The land size measurement comes from the household survey where multiple members of the agricultural household offer up their recollection of various dynamics so as to capture full dynamics instead of relying on just one member’s knowledge of the household. An aggregate estimate of this measure was then created and appended to the segmentation, which is based on participant responses to the individual questionnaire (asked of just one randomly selected household member). These data are weighted accordingly. Use data with caution surrounding extrapolation and inferences. These should be used only as added descriptive measures.

FIGURE 121. View saving money through different mediums as very important

Sample: “Battling the elements” households, n=574

Nine percent of these individuals have an account with an NBF, and 9 percent also have a bank account. Just over one-third have been inside a bank.

Access to informal financial accounts surpasses that of formal accounts, with 54 percent having accessed some informal financial service. Village savings and loan associations are the most common informal service (30 percent have used), followed by a ROSCA (19 percent have used). Only 2 percent have used money guards or someone who collects savings deposits.

Separate from having financial mechanisms, we also see a gap in perceived importance of financial behaviors for the “battling the elements” group. Like the “farming for sustenance” segment, just over four-fifths (82 percent) of those in the “battling the elements” segment feel it is very important to save for future purchases, or school fees (84 percent), and fewer find it important to save for the unexpected (73 percent) or regular purchases (67 percent). Many (82 percent) find it very important to invest money in the farm.

There is a greater perceived importance in saving through financial mechanisms, both formal and informal, versus the

“farming for sustenance” group, but having savings within the home is still important to half of this group (Figure 121).

Segment 3: “Diversified and Pragmatic”: Realistic, grounded and plan accordingly for the realities of agricultural life³⁶

The “**diversified and pragmatic**” segment, which includes just 4 percent of Uganda’s smallholder households, is moving away from vulnerability and onto a path of stability. Perhaps what is most important about this group is its relatively small size, suggesting a lack of use cases and models in the marketplace for coming out of vulnerability. Its size is also important in level-setting expectations as to what financial and agricultural mechanisms meant for a less-entrenched household might achieve. In time, this group can grow to be more substantial.

Characterizing attributes: comparisons to other segments

Perhaps the most distinguishing tendency of the “diversified and pragmatic” group is how so many of them look for opportunities to improve their situations (87 percent) and their relatively negative outlook on the agricultural

³⁶ Caution: Small segment size limits analysis. Proceed with caution in extrapolating findings

SEGMENT SYNOPSIS

The “diversified and pragmatic” segment reflects the realism and inner conflict that can characterize smallholder farming households. These households grow more, sell more, earn more, have more income streams and have a broader portfolio of financial mechanisms.

They are the most likely to have experienced unexpected events in the past 12 months, but least likely to have had their agricultural activities affected by multiple negative events (e.g., pests, weather) in the past 3 years. They do not believe it is very possible to acquire emergency funds and are the most likely to take a full-time job.

The conflict that arises in this group is that despite enjoying farming, taking pride in it, and looking for opportunities to grow it, many would diversify out of agriculture if given the opportunity.

They are empowered, but believe that someone else or circumstances, more generally, might have more power than they do to shape their destiny. They think through decisions, but also know that reality can get in the way of the best-laid plans. This is an important group, as it represents smallholder households that have diversified within and outside of agriculture to best sustain their household needs.

sector (82 percent want to stay in agriculture, 50 percent want other kinds of work and just 82 percent enjoy working in agriculture).

They also work hard to be the best (96 percent), and can be impulsive (37 percent), suggesting they tend to be risk-takers. Despite their predisposition to being risk-takers and opportunity seekers, a sizable portion of those in this group do feel their lives are determined by other, powerful people (36 percent), perhaps reflecting they have emerged from circumstances beyond their control.

Demographics: All households live above the poverty line, are concentrated in the Central and Western regions of the country, and are largely headed by older farmers.

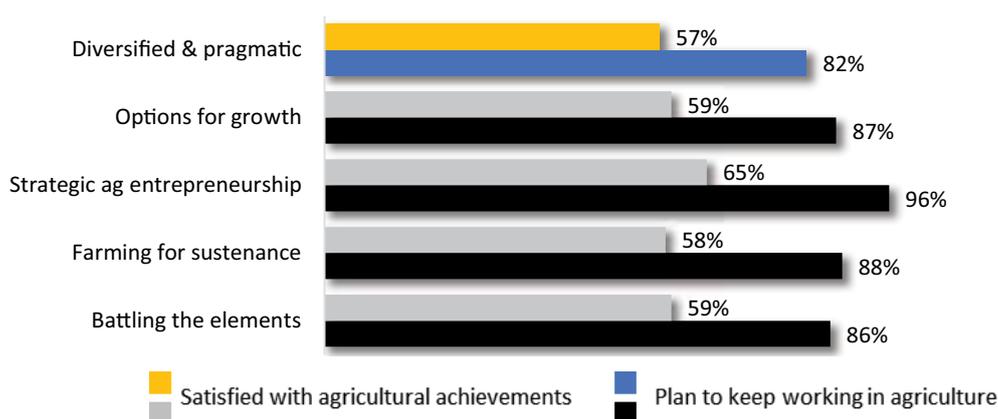
The “diversified and pragmatic” group tends to be slightly older (56 percent, 40 years+) than the prior groups. Just over three-fourths (77 percent)

live in the central and western regions of the country, leaving close to one-fifth (18 percent) in the Eastern, and 5 percent in the Northern regions. This entire group (100 percent) lives above the poverty line.

Farming: Experience, income, and crops

“Diversified and pragmatic” households are mostly experienced in farming. More than half have been farming for 10 or more years (53 percent), and an additional 19 percent have been in it for six to 10 years. Versus the “battling the elements” group, we see fewer people in that tenured, more than 10 years, category. Twenty-six percent have been farming for five or fewer years.

These households mostly intend to continue working in agriculture (82 percent), showing similar intentions as other segments. They generally enjoy it (82 percent), and many would like

FIGURE 122. View of success in agriculture vs. willingness to continue working in it

Sample: All smallholder households who participate in agricultural activities by segment

to expand their capabilities (85 percent). That said, it is fair to point out that full-time employment could also be attractive to these smallholder households (67 percent), reflecting their pragmatism. Farming is hard work, and susceptible to elements that make it unpredictable, or difficult to grow the business. This segment is the least satisfied with what their agricultural work has achieved, at just under six in 10 (57 percent), suggesting they are critical of themselves, and perhaps wanted better outcomes that their circumstances could not support (Figure 122).

More sources of income

Nearly nine in 10 (89 percent) of “diversified and pragmatic” households generate income from agriculture, and, overall, these households tend to be the least diverse in growing and selling crops (85 percent) and rearing livestock (43 percent). Other sources of income for the “diversified and pragmatic” households can include:

- Money from family and friends (28 percent)

- Wages from occasional jobs (22 percent)
- Running a business that provides services (18 percent)

For all household members active in agriculture, 62 percent of the households in “diversified and pragmatic” have two hectares of land or less. Up to an additional 23 percent have between two and three hectares, and the rest have over three hectares of land.³⁷

On average, the “diversified and pragmatic” are growing six crops (6.18 precisely) each year on their land. They tend to sell, on average, three crops they grow (3.12 precisely).

Affected by outside elements

This group was most likely to have experienced unexpected externalities (98 percent), but least likely to have had their agricultural activities affected by two or more issues (e.g., floods, pests) in the prior three years. Just over two-thirds of this segment (69 percent) was affected by weather alone. Almost three-fourths (76 percent) of

³⁷ The land size measurement comes from the household survey where multiple members of the agricultural household offer up their recollection of various dynamics so as to capture full dynamics instead of relying on just one member’s knowledge of the household. An aggregate estimate of this measure was then created and appended to the segmentation, which is based on participant responses to the individual questionnaire (asked of just one randomly selected household member). These data are weighted accordingly. Use data with caution surrounding extrapolation and inferences. These should be used only as added descriptive measures.

FIGURE 123. View saving money through different mediums as very important

Sample: “Diverse and pragmatic” households, n=144

these smallholders faced pests and disease issues. The majority (58 percent) did not have a specific response to cope with these events and did nothing in particular when they occurred.

Financial attitudes

The segmentation model itself is built off of predictors of financial inclusion, defined as those having a full-service bank, mobile money or NBFi account in their name. Close to half (46 percent) of the “diversified and pragmatic” segment is financially included, which is close to double that of the general population of farmers.

While a small portion of the population, this segment is the one that offers hope that farming households can put their livelihoods on a path toward greater stability that includes mechanisms for household management. With close to half of this segment not financially included, it suggests that targeted efforts might be well placed, and the collective reach of those efforts might extend far beyond the people within the segment.

A “pragmatic” approach to finances

Mobile money accounts are the most popular formal financial mechanisms among the “diversified and pragmatic”

segment. Thirty-nine percent have a mobile money account, and 41 percent have used mobile money either through their own or through someone else’s account. Ninety percent of “diversified and pragmatic” smallholder households were aware of at least one mobile money provider prior to the survey.

Nine percent of smallholders in this segment have NBFi accounts, and 12 percent have bank accounts. Close to four in 10 (38 percent) had ever been in a bank.

The “diversified and pragmatic” smallholders are the first for which access to informal services does not surpass that of formal accounts, with nearly four in 10 (38 percent) having access to some informal financial service. Village savings and loan associations (VSLAs) are the most common form of informal financial services, used by 26 percent of this segment. Sixteen percent had used ROSCAs or Chamas, and 15 percent had used a shopkeeper.

Separate from having access to financial mechanisms, there is less acknowledgment of the importance of financial behaviors, such as saving. This segment is one of the least likely to view saving through any mechanism—other than cash at home—as very important. Though a majority believes saving

for specific purposes (e.g., school fees, regular expenses, the future) is very important, they are least likely to value saving for regular expenses or investing in future educational opportunities.

Similar to all other groups, those in the “diversified and pragmatic” segment consider saving at financial institutions the best, or, on par with informal savings options. However, it is in the “diversified and pragmatic” segment that the greatest emphasis is on saving at home (Figure 123).

Segment 4: “Options for Growth”: Stable, optimistic and building various paths for the future

Smallholder households in the “**options for growth**” segment comprise 16 percent of the smallholder population. The biggest characterizing elements of those in this group are their level of financial inclusion, youth, and recent entry into agriculture, which distinguishes them from every other segment. They have access to financial tools, more “options for growth” and feel more empowered than other groups (just 34 percent feel their lives are determined by other, powerful people).

That they are optimistic does not mean there is no room for growth. Their optimism conveys they have improved their current situations, largely because of their net incomes. Furthermore, it might not be farming income alone that helps stabilize their households, as agriculture is part of the household’s diverse revenue streams.

Characterizing attributes: comparisons to other segments

“Options for growth” households tend to be newer to farming and are looking to expand their agricultural activities. They already look to farming as a legacy, and something in which they take pride. Despite their interest in other sectors of work, they are also the most likely to want their children to default into agriculture without considering other opportunities.

The “options for growth” smallholder households are also motivated, hard-working and opportunistic. Eighty-five percent share they have many aspirations, and nearly all (99 percent) work hard to be the best, while 88 percent look for opportunities to improve their situations. Very few are impulsive

SEGMENT SYNOPSIS

The “options for growth” group has greater access to financial tools and external support, few uneducated individuals, and feels least oppressed by powerful figures. But their youth, optimism and interest in opportunities outside of agriculture could also mean their future takes them in one of two directions, within or outside of agriculture.

The segment relies heavily on agricultural income, but is also the most likely to be engaged in more stable income sources outside of agriculture, such as running one’s own business or working a regular, full-time job.

The youngest of all groups, this segment could pivot in either direction depending in part on how they are cultivated by policymakers, development organizations and financial institutions.

(28 percent), and a small portion are inclined to think the future will take care of itself (21 percent).

Demographics: Less than half of smallholder households in this segment live in poverty and are spread across the central, eastern and western regions of the country, and tend to be younger farmers.

The “options for growth” group tends to be young, with just over half under 40 (50 percent). This segment is fairly spread out geographically, with almost 90 percent living across three regions (Central: 24 percent, Western: 27 percent, Eastern: 36 percent).

Over half of this group (58 percent) lives above the poverty line. It may seem counterintuitive that some portion of a segment called “options for growth” falls below the poverty line, however, individual upward mobility and drive for financial services (off of which the segmentation model was built) can cross the poverty line, resulting in lower income groups behaving more like higher income groups.

Farming: Experience, income and crops

“Options for growth” individuals are newer to farming. One-third (33 percent) have been farming for five or fewer years, a higher percentage by at least 8 percent, compared with other groups. Forty-six percent have been farming for 10 or more years, the smallest percentage among the five segments, with 20 percent being engaged in agriculture from six to 10 years.

These smallholder households mostly intend to continue working in agriculture (87 percent), showing similar intentions as other segments. They derive great enjoyment from it (90 percent), and many would like to expand their capabilities (92 percent). In fact, they are even more likely to want to expand their capabilities than other segments.

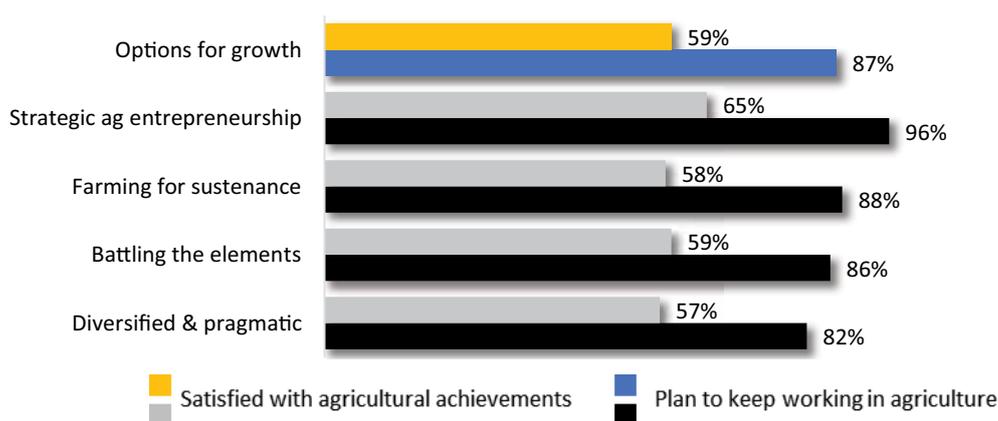
Wanting to expand their agricultural activities

That said, it is worth noting that full-time employment could also be very attractive. Many say they want to grow their farming (92 percent), but, at the same time, most say they would welcome full-time employment (66 percent). This suggests they may, at some point, determine that the best path for their future is outside of agriculture.

Just under six in 10 (59 percent) smallholders in this segment are satisfied with what their agricultural work has achieved (Figure 124), exacerbating this contradiction. This is also a potential call to action in that, if this group cannot be successful in farming and discovers other options, then they may change direction. The question becomes, “What do they need to stay in farming?” given their limited success with it.

Up to 59 percent of the smallholder households in the “options for growth” group have two hectares of land or less. Up to an additional 15 percent have between two and three hectares, and the rest have over three hectares of land.³⁸ This group tends to have larger amounts of land than some other segments.

³⁸ The land size measurement comes from the household survey where multiple members of the agricultural household offer up their recollection of various dynamics so as to capture full dynamics instead of relying on just one member’s knowledge of the household. An aggregate estimate of this measure was then created and appended to the segmentation, which is based on participant responses to the individual questionnaire (asked of just one randomly selected household member). These data are weighted accordingly. Use data with caution surrounding extrapolation and inferences. These should be used only as added descriptive measures.

FIGURE 124. View of success in agriculture vs. willingness to continue working in it

Sample: All smallholder households who participate in agricultural activities by segment

Nearly 90 percent (88 percent) of “options for growth” households generate income from agriculture, and, overall, these households tend to use both livestock (56 percent) and crops (85 percent) for income. The “options for growth” households tend to have the most diverse sources of income beyond agriculture, at least one-quarter obtain income from family and friends (32 percent), regular jobs (27 percent), occasional jobs (25 percent), or from running their own retail/manufacturing business (25 percent).

Sell a high number of crops

On average, the “options for growth” smallholders are growing seven different crops each year on their land, the second highest number (6.86 precisely) among the groups. They tend to sell, on average, four crops they grow (3.74 precisely).

Ninety-seven percent of those in the “options for growth” segment have been seriously affected by an outside element, including weather, pests and disease, accidents, market fluctuations, equipment failure and/or their own health issues. Nearly eight in 10 (79 percent) were affected by weather alone. A similar amount (77 percent) faced pests and disease issues.

Among those who were seriously affected by any of the above events, 44 percent of households did nothing specific in response. In fact, there is no one solution that conjured over 32 percent. For instance, when this group experienced an unexpected event:

- 32 percent coped by using savings
- 14 percent sold livestock or crops
- 11 percent borrowed money informally
- 7 percent sold assets
- 4 percent obtained a temporary job

Financial attitudes

The segmentation model itself is built off of predictors of financial inclusion, which is defined as having a full-service bank, mobile money or NBFi account in their name. It follows, then, that ordering segments from “farming for sustenance” to the more optimized groups shows a somewhat linear relationship with financial inclusion. Overall, 26 percent of Uganda smallholder households are financially included, meaning that they have a full-service bank, mobile money, NBFi accounts in their name.

Much higher financial inclusion

Just over two-thirds (67 percent) of the “options for growth” segment is financially included, which is 21 percent higher than that of the “diversified and pragmatic” group. While a small portion of the population, this segment is also one that offers hope that smallholder households can put their livelihoods on a path toward greater stability as well as growth.

Mobile money accounts are the most popular formal financial means among those in the “options for growth” group. Fifty-six percent have a mobile money account, and 64 percent can access mobile money either through their own or through someone else’s account. Ninety-nine percent of “options for growth” had heard of mobile money prior to the survey.

Moderate bank account use

Nineteen percent of smallholders in the “options for growth” segment have an NBFi account, and 31 percent have a bank account—the highest among all segments. Almost two-thirds (64 percent) had been in a bank—four times that of those in the “farming for sustenance” segment.

Roughly half (52 percent) have access to an account at an informal institution, most commonly a VSLA (31 percent) followed by a ROSCA or Chama (12 percent).

There is also some use of the following:

- Shopkeepers (10 percent)
- Informal saving and credit groups other than ROSCAs or Chamas (8 percent)
- Moneylenders (6 percent)

Separate from having financial mechanisms, there is acknowledgment of the importance of financial behaviors, such as saving. Nearly all of the smallholders in this group (89 percent) feel it is important to save for future purchases, and many also find it very important to save for school fees (85 percent). Fewer, but still most, find it important to save for the unexpected (77 percent), or regular purchases (70 percent). There also is a strong belief in the importance of investing in the farm (86 percent very important). For the “options for growth” segment, saving at financial institutions is considered the most favorable option both within the segment and across all five segments (Figure 125).

FIGURE 125. View saving money through different mediums as “very important”



Sample: “Options for growth” households, n=569

Segment 5: “Strategic Agricultural Entrepreneurship”: Actively engaged, empowered and growing their agricultural activities³⁹

The “strategic agricultural entrepreneurship” segment includes just 4 percent of Uganda’s smallholder households, and comes in as the second smallest of all five segments. This segment, comprised of those who have emerged from life’s events empowered and enabled, is one of the smallest. Like the “diversified and pragmatic” and “income optimized” segments, this tells us there are limited examples in the agricultural community of optimization and success.

Characterizing attributes: comparisons to other segments

The “strategic agricultural entrepreneurship” group is wealthier and more educated, and more prepared in the event of an emergency (having access to emergency funds) and faces

the fewest technological barriers. The group presents itself as having encountered—and emerged from—more unexpected events in recent years than have most other segments. Their experience appears to have served them well given their other desirable psychographics.

Like the “battling the elements” group, these smallholder households tend to be tenured farmers, who are looking to expand their agricultural activities. However, there is collectively less focus on agriculture as the path for future generations.

The “strategic agricultural entrepreneurship” smallholder households are motivated, thoughtful in their work, and opportunistic. They have many aspirations (87 percent), take action after much thought (90 percent), and most are constantly looking for ways to improve their situations (88 percent). They, like most other groups, are risk averse (24 percent are impulsive).

SEGMENT SYNOPSIS

The “strategic agricultural entrepreneurship” segment includes households who appear to be actively engaged in building their agricultural work, with some indications of success or at least progress. The group is more enabled than others, has higher income, more education, greater access to emergency funds, and more financial mechanisms at their disposal. They have been impacted by the realities of farming, and have been able to rely upon their savings or other resources to get through tough times.

What characterizes those in this segment more definitively though is their mindset. They put much thought into what they do. They have big aspirations that include a future in farming. Farming is what they want to do, what satisfies them, where their legacy lives. They are not as likely to want out of agriculture, and are the most satisfied with their achievements in the sector, but they are also the most pessimistic about the future.

This is a group that can be a model or a use-case for carrying meaningful messages (or examples) for growth in other segments of the population.

³⁹ Caution: Small segment size limits analysis. Proceed with caution in extrapolating findings.

Demographics: None of the smallholder households in this segment live below the poverty line. They are mostly concentrated in the central and western regions of the country, and are the second oldest group of farmers.

The “strategic agricultural entrepreneurship” group tends to be older, with 62 percent over 40; an additional 19 percent are between 15 and 29, and 19 percent are between 30 and 39. This segment is lightly concentrated in the North (3 percent). The largest groups are in the Central region (38 percent) and the Western region (36 percent), and the remaining 22 percent are in the Eastern region. The entire segment, 100 percent, is above the poverty line.

Farming: Experience, income and crops

“Strategic agricultural entrepreneurship” individuals are relatively tenured farmers. One-fourth (23 percent) have been farming for five or less years, and an additional 12 percent have been farming between six and 10 years. Almost two-thirds (64 percent) have been farming for 10 years or more.

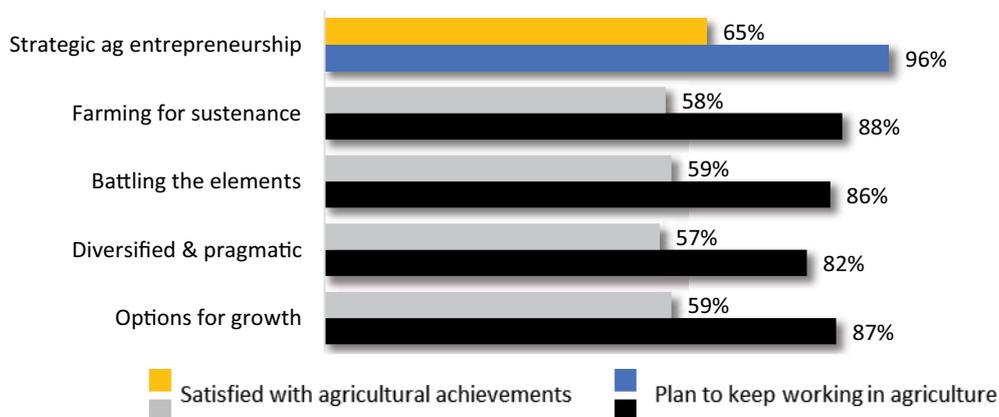
Continue working in agriculture

These smallholder households mostly intend to continue working in agriculture (96 percent), showing similar intentions as other segments. They almost all enjoy it (94 percent), and many would like to expand their capabilities (92 percent). In fact, they are even more likely to want to expand their capabilities than other segments.

That said, it is fair to point out that full-time employment could also be attractive to many in this segment (67 percent). Seven in 10 (65 percent) smallholders in this segment are satisfied with what their agricultural work has achieved (Figure 126), the most among all segments, showing a significant contradiction, but also a potential call to action. If this group cannot be successful in farming, and do wind up with other options, they may change direction. The question becomes, “What do they need to stay in farming?” given their success at it.

Nearly 50 percent of the households active in agriculture in the “strategic agricultural entrepreneurship” segment have two hectares of land or less. Up to an additional 13 percent have between

FIGURE 126. View of success in agriculture vs. willingness to continue working in it



Sample: All smallholder households who participate in agricultural activities by segment

two and three hectares, and the rest have over three hectares of land.⁴⁰ This group tends to have the largest amount of land among all the groups.

More sources of income

Just over nine-tenths (91 percent) of “strategic agricultural entrepreneurship” households generate income from agriculture, and overall, these smallholder households tend to be more likely to raise livestock (67 percent) and grow and sell crops (85 percent) than the other groups, suggesting that farming is a collection of income sources, not the sole income source. In addition to agricultural income, more than one-eighth of “strategic agricultural entrepreneurship” smallholders generate income from running a retail or manufacturing business (26 percent), family and friends (24 percent), occasional jobs (16 percent), running one’s own services business (15 percent), or a regular job (13 percent).

On average, those in the “strategic agricultural entrepreneurship” group are growing the third most crops each year on their land at seven (6.82 precisely). They tend to sell on average four crops they grow (3.91 precisely).

Ninety-seven percent of the “strategic agricultural entrepreneurship” smallholders have been seriously affected by an outside element including weather, pests and disease, accidents, market fluctuations, equipment failure and/or their own health issues. Just 40 percent did nothing to cope with these events.

Financial attitudes

Overall, 26 percent of Ugandan smallholder households across the country are financially included, meaning they have a full-service bank, mobile money, or NBF account in their name. The majority (63 percent) of the “strategic agricultural entrepreneurship” segment is financially included, and most of those in this group (57 percent) have mobile money accounts—the highest of all five segments.

Sixty-six percent have used mobile money, and nearly all (99 percent) have heard of mobile money. Bank account and NBF account ownership are at 20 percent and 18 percent, respectively. Just over half (52 percent) of these smallholders have been in a bank.

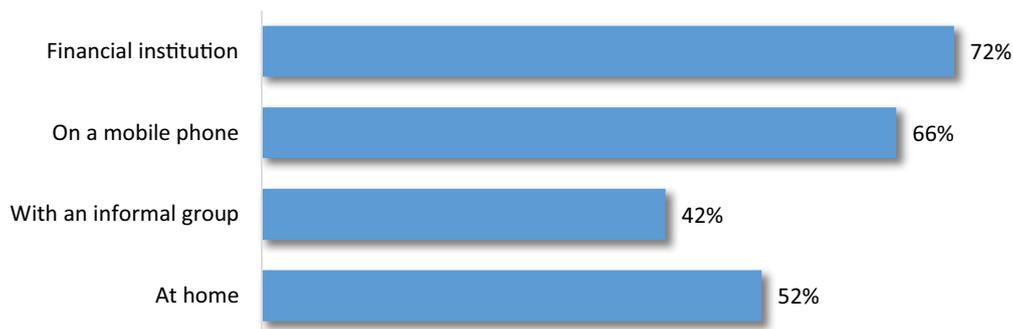
Just over half (54 percent) have access to an informal account:

- 32 percent have used a VSLA
- 16 percent have used a ROSCA or Chama
- 13 percent have used a shop keeper
- 13 percent have used an informal saving and credit group other than ROSCAs

Importance of saving

Separate from having financial mechanisms, we see greater acknowledgment of the importance of financial behaviors, such as saving. Most (90 percent) feel it is very important to save for future purchases, unexpected expenses

⁴⁰ The land size measurement comes from the household survey where multiple members of the agricultural household offer up their recollection of various dynamics so as to capture full dynamics instead of relying upon just one member’s knowledge of the household. An aggregate estimate of this measure was then created and appended to the segmentation, which is based on participant responses to the individual questionnaire (asked of just one randomly selected household member). These data are weighted accordingly. Use data with caution surrounding extrapolation and inferences. These should be used only as added descriptive measures.

FIGURE 127. View saving money through different mediums as very important

Sample: "Strategic agricultural entrepreneurship" households, n=160

(66 percent), and school fees (75 percent). There is also more emphasis on investing in the farm (84 percent). And, it follows that saving with formal institutions outweighs informal options (Figure 127).

Market implications for all segments

In a population like smallholder farming households in Uganda, where households share more attitudinal, behavioral, and circumstantial commonalities than they do differences, this segmentation model offers a dynamically nuanced perspective so that uniqueness within a population can be appreciated and even leveraged for positive market interventions.

While it is safe to say that a large portion of the population as a whole proceeds with their livelihoods without the use of formal financial mechanisms and/or facilitative tools for improving their household stability and agricultural yield, it is really the "farming for sustenance" and "battling the elements" groups that are the furthest away from those mechanisms and tools. These groups also lack context for why those mechanisms and tools can be so essential, what they can bring to their lives, or why they should adopt them if available.

It follows then these are households that will need a greater degree of conditioning, or information about why

certain financial mechanisms or agricultural tools are important for them. Their focal point is often the household and household needs (vs. their agricultural activities), and connecting to this target consumer and their household needs could present opportunities for building that needed relevance and importance.

What it takes to build inroads into these segments may feel laborious, especially given the low income of these individuals. These two groups, however, also comprise "critical mass," as they are the two largest segments within the population. The value may be in the collective size of the market, instead of the yield of each person in the market.

The "diversified and pragmatic" and "options for growth" groups share characteristics with the others, but distinguish themselves by their current point in farming—a juncture that could prove critical. These groups have more options, and may give more serious consideration to leaving agriculture if a more profitable alternative presented itself. They take pride in their agricultural work, and enjoy it, but the pragmatic, realistic, and even futuristic side of them suggests they might need (and want) to pursue other paths.

In Uganda, these two segments combined total 20 percent of the smallholder farming population, and have a

promising, attractive profile for financial services entities looking to make productive inroads into the population. They have experience with financial products, along with life experiences (e.g., hardship, crop loss) that have taught them the value of financial products. A financial services provider need not convince them of the importance of financial products, or that they should have them. Instead, a provider needs to show the virtues of a product and how it enables farmers' aspirations more so than existing tools.

The fifth group, "strategic agricultural entrepreneurs," presents the best opportunity for deepening a household's productive—and fruitful—commitment to agriculture. However, this is the smallest segment, constituting only 4 percent of the smallholder population. These are households who, while still

diversified, are most committed to staying in agriculture, growing their farms, building a legacy and future in farming, and by many indications, currently doing it well. Their value is not in their size. Their value is in their potential role as "use cases," illustrating for other groups upward mobility in a sector that has a shared passion for their craft. As well, their existing financial knowledge and practices can provide an opportunity to test more advanced, deeper-reaching interventions before taking them to the mass market.

Even in a more homogenous market, multiple approaches and strategies combine to best position financial and agricultural mechanisms for meaningful uptake and use within a population, giving providers the opportunity to better calculate out their approach and potential return.

7. DESIRES AND ASPIRATIONS: SMALLHOLDER HOUSEHOLDS STRONGLY SEE THE IMPORTANCE OF SAVING AND INVESTING IN FINANCIAL INSTITUTIONS

Contrary to Mozambique,⁴¹ there is a relatively high level of perceived relevance among smallholder households in Uganda of some financial products, most notably a mobile money account, bank account (nonsavings), and savings account. Between two-fifths and half of smallholder households said either it is “not important” or they “do not know” the importance of credit or insurance (Figure 128). The findings are similar when you ask smallholder farmers about the perceived relevance of these financial products to their agricultural activities (Figure 129).

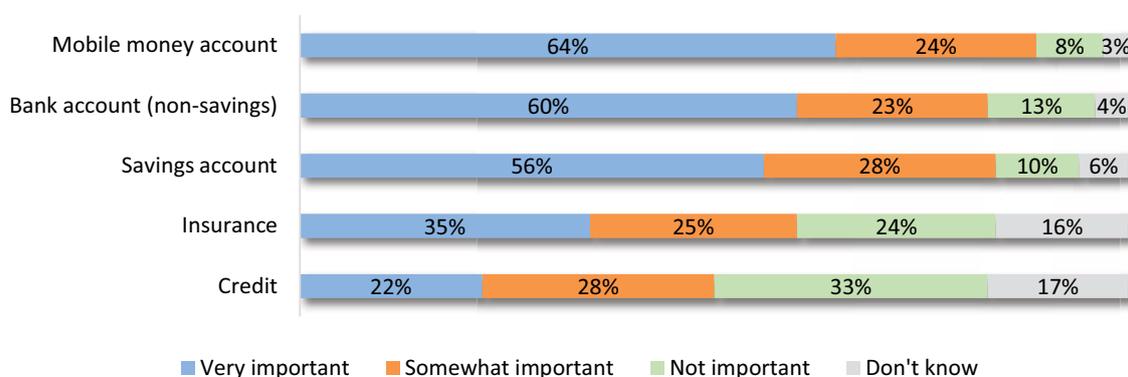
This perceived relevance of financial tools for either their households or their agricultural activities carries through to the importance of saving. When asked where they should save, a majority of smallholder farmers believe it is very important to save at a financial institution and even on a mobile phone (Figure 130). There is a great opportunity here as the inherent importance for Uganda smallholder farmers is already

present. Saving with an informal group received the lowest level of importance.

Smallholder farmers in Uganda place a relatively high importance on their household saving habits. The majority feel it is very important to save for future purchases, school fees, an unexpected event, and for regular purchases (Figure 131). The greatest number believes that saving for a future purchase is the most important, followed closely by saving for school fees. When asked what they need to do the most, a plurality chose school fees (Figure 132), followed closely by a future purchase.

Smallholder farmers have unique views on storing and saving money. They place a strong emphasis on storing money somewhere they trust and needing to access their money immediately (Figure 133). They also feel they need to store money somewhere for a specific purpose, and they like to save money in case of an emergency. These desires do not always translate into practice.

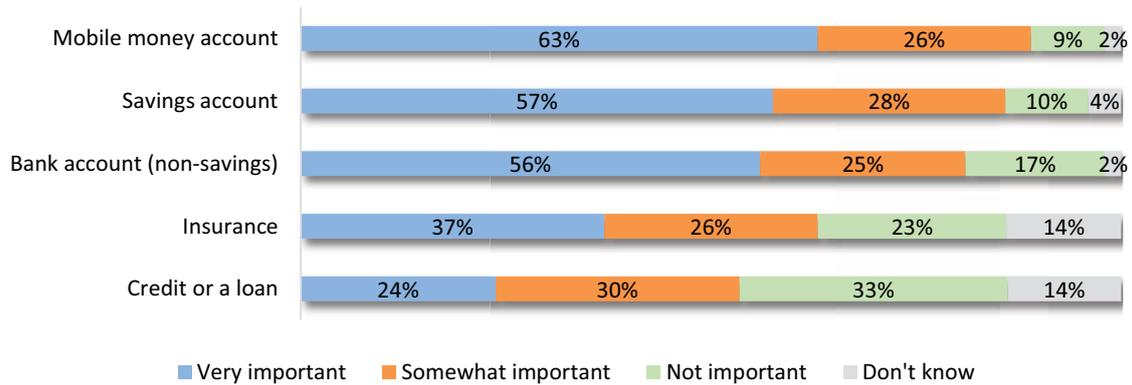
FIGURE 128. Regardless of what you have, how important is it to your household to have the following?



Sample: Smallholder households, n=2,870

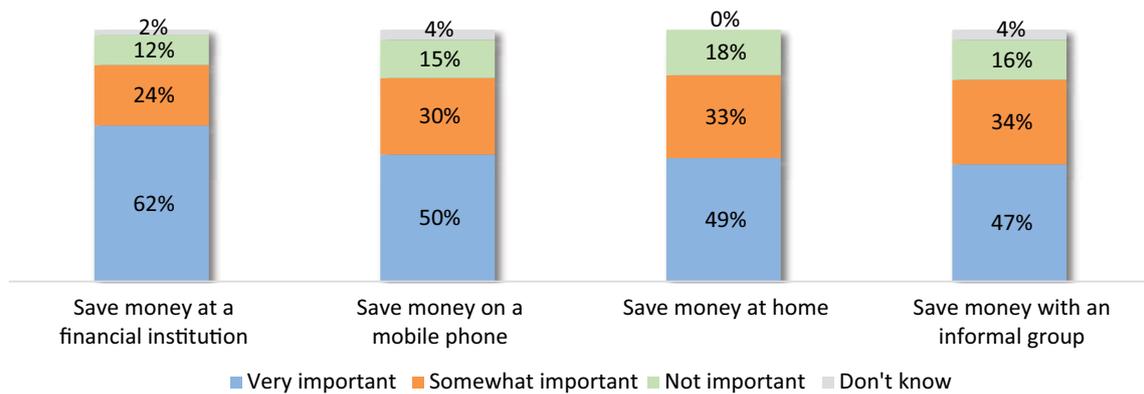
41 CGAP National Surveys & Segmentation of Smallholder Households in Mozambique, 2015-2016; <http://www.cgap.org/publications/national-survey-segmentation-smallholder-households-mozambique>.

FIGURE 129. How important is it to your agricultural activities to have the following?



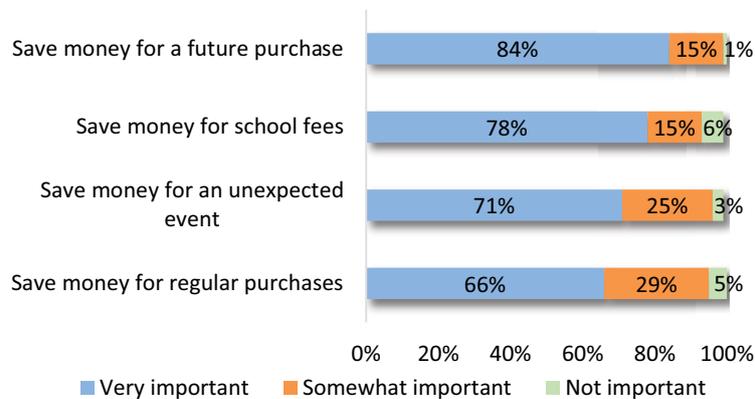
Sample: Smallholder farmers, n=2,771

FIGURE 130. How important is it for your household to save at each of the following?



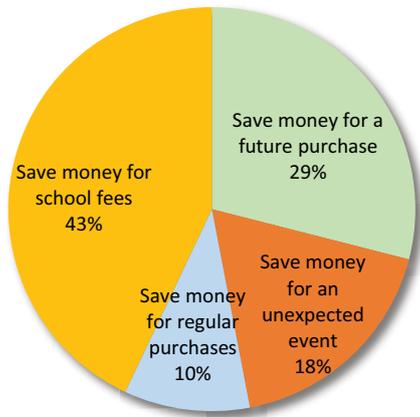
Sample: Smallholder farmers, n=2,771

FIGURE 131. How important is it for your household to save for each of the following?



Sample: Smallholder farmers, n=2,771

FIGURE 132. Which of the following do you feel your household needs to save for the most?



Sample: Smallholder farmers, n=2,771

Smallholder farmers in Uganda place the highest level of importance on investing in their farms, and a strong majority feels it is very important to invest in a future educational opportunity (Figure 134). When it comes to what they need to invest in the most, smallholder farmers are mostly split between an educational opportunity and their farms (Figure 135).

Desires and Aspirations: Smallholder households prefer to borrow from friends and family

More smallholder farmers in Uganda recognize the importance of borrowing from family and friends than they do formal financial institutions (Figure 136).

Banks and microfinance institutions trail family and friends, (39 percent, 25 percent respectively).

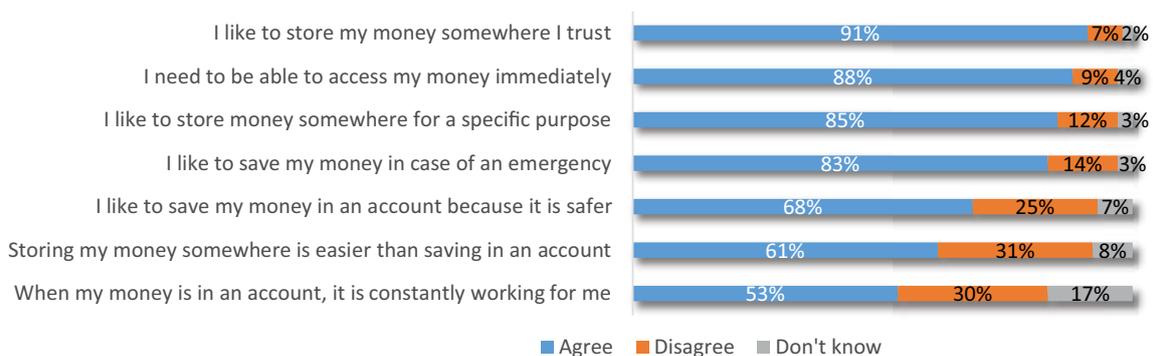
Combined with their habits, this shows that not only do Ugandan smallholders go to friends and family first when attempting to borrow, they would prefer to do so in the future (Figures 137 and 138). When asked where they would attempt to borrow from for agricultural activities, almost nine-tenths of farmers said they would go to friends and family first, and just under half would go to a bank (Figure 138). Only 4 percent said they had ever attempted to borrow from a bank, underscoring the lack of exposure and experience with formal financial institutions.

Smallholder farmers may have interest in borrowing, but the overwhelming majority of farmers do not currently have any outstanding loans (Figure 140). The top reasons for borrowing money would be focused on their emergency expenses or businesses, whether it is to start/expand their businesses or use the money for other agricultural activities (Figure 141).

Desires and Aspirations: There is high interest in plans for credit or savings inputs and school fees

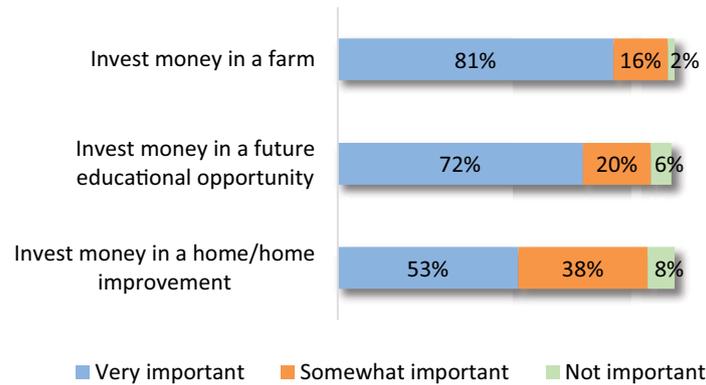
While financial practices and top interests orient smallholder farmers in Uganda toward informal financial mechanisms, a

FIGURE 133. Do you agree or disagree with the following statements?



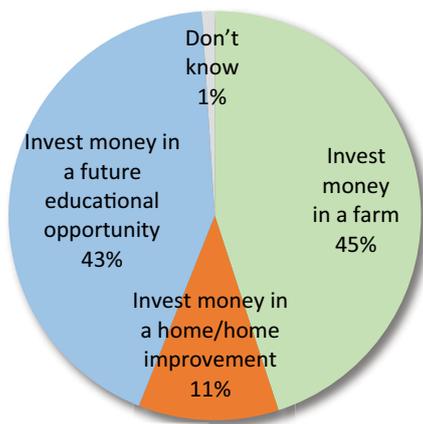
Sample: Smallholder farmers, n=2,771

FIGURE 134. How important is it for your household to invest in each of the following?



Sample: Smallholder farmers, n=2,771

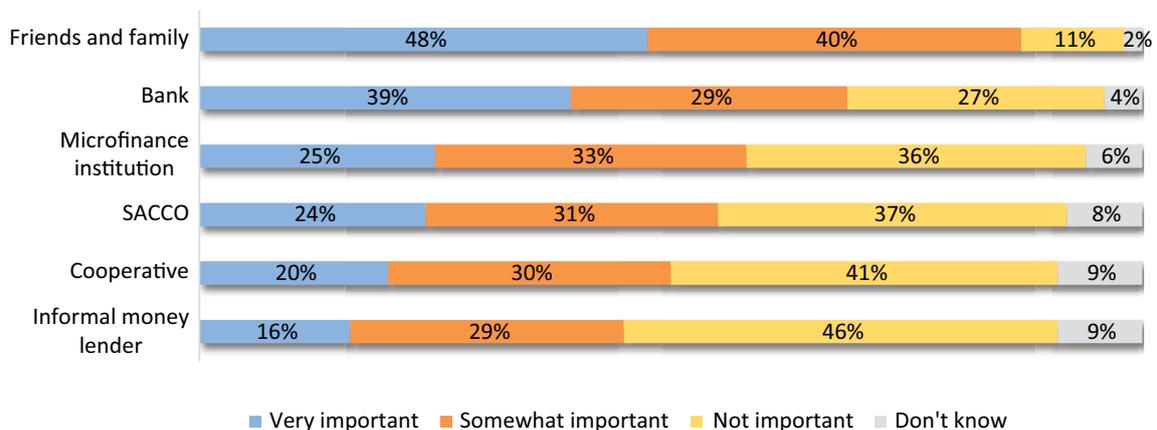
FIGURE 135. Which of the following do you feel your household needs to do the most?



Sample: Smallholder farmers, n=2,771

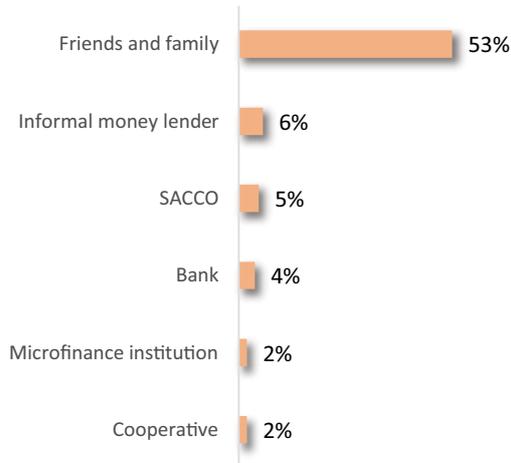
number of financial products resonate as important for this group, presenting an opportunity to build meaning and relevance for more formal financial mechanisms. Smallholder farmers find savings, and credit or payment plans for school fees and inputs (Figure 142) to be important to their agricultural activities. Comparatively, prepaid cards and mobile money accounts have less recognized importance. Some of the lower importance comes from lack of awareness (roughly one-quarter said they “don’t know” if it is important). Very few smallholder farmers have any of these products currently, with the highest percentages at 5 and 7 percent for payment and savings plans for inputs, respectively (Figure 143).

FIGURE 136. For your agricultural activities, how important to you is it to borrow from each of the following?



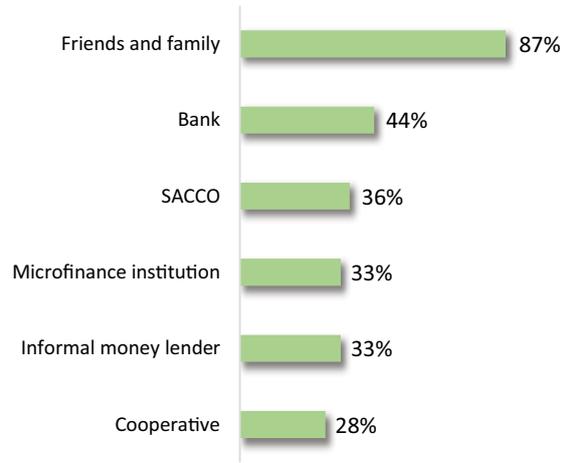
Sample: Smallholder farmers, n=2,771

FIGURE 137. In the past 12 months, have you attempted to borrow from any of the following?



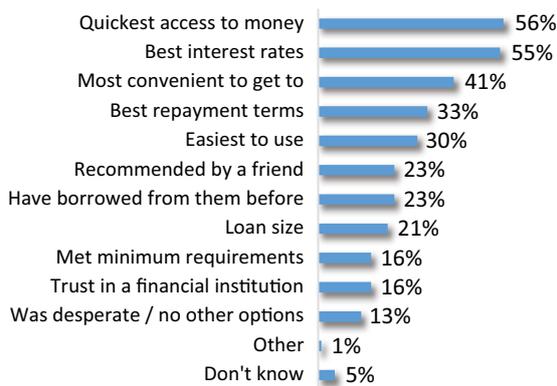
“Yes” answers
Sample: Smallholder farmers, n=2,771

FIGURE 138. If the need arose, would you attempt to borrow from any of the following?



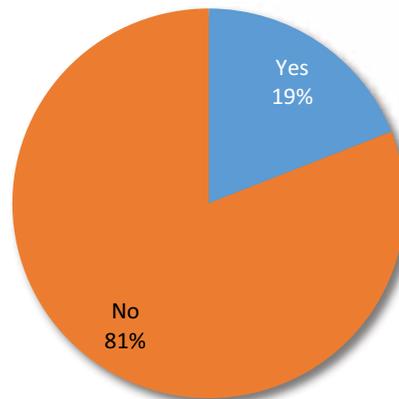
“Yes” answers
Sample: Smallholder farmers, n=2,771

FIGURE 139. What factors would you consider when you want to borrow money?



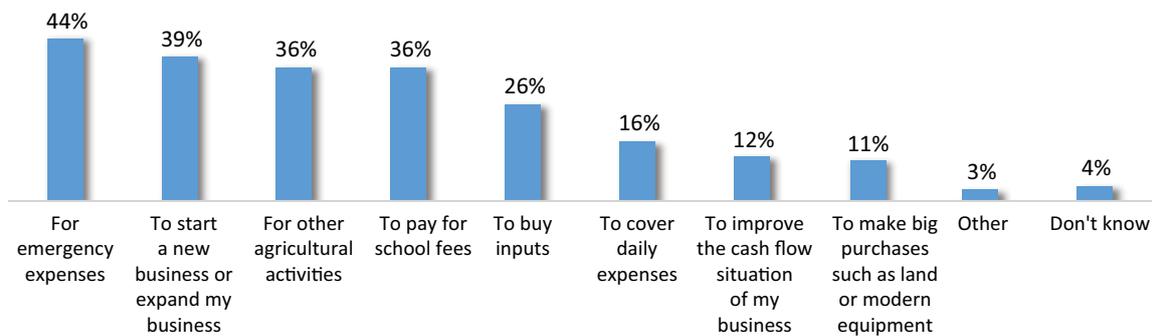
Sample: Smallholder farmers, n=2,771
Multiple responses allowed

FIGURE 140. Do you currently have any loans?



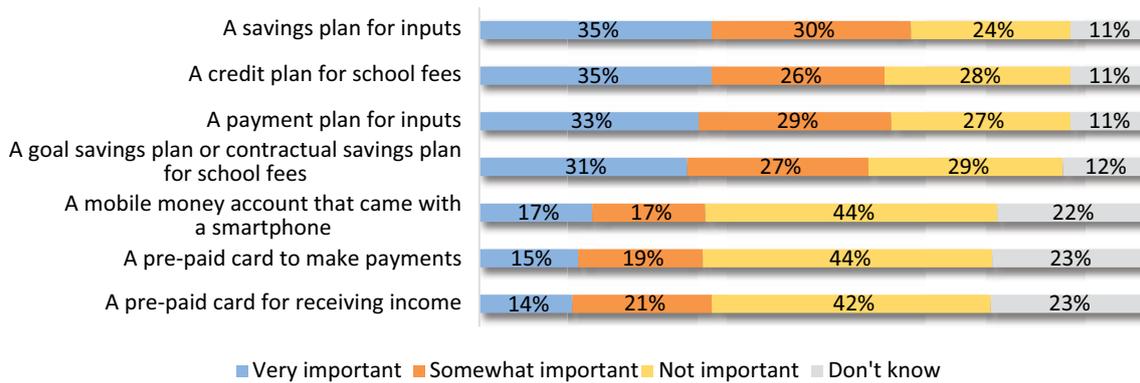
Sample: Smallholder farmers, n=2,771

FIGURE 141. What would be the main reasons for borrowing money?



Sample: Smallholder farmers, n=2,771
Multiple responses allowed

FIGURE 142. How important is each of the following products to your agricultural activities?



Sample: Smallholder farmers, n=2,771

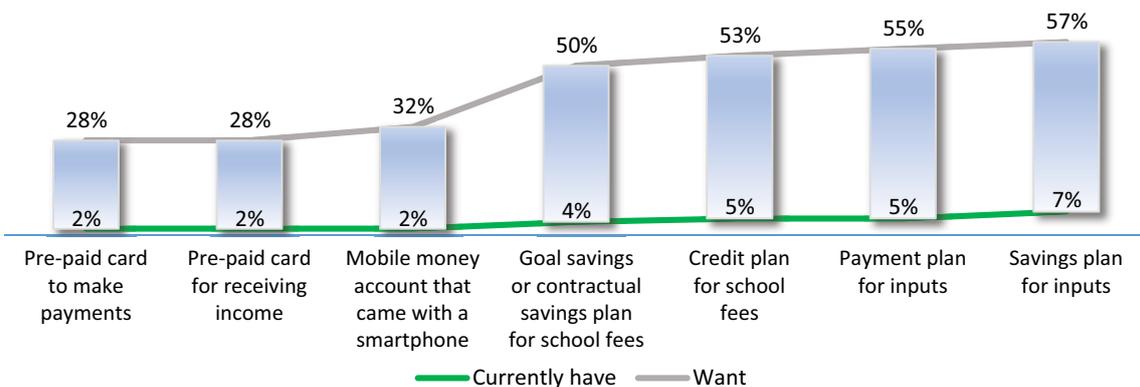
For those who do not currently have these products, the highest demand is for payment and savings plans for inputs, showcasing how important these are to smallholders' agricultural activities. School fees present an important opportunity, as nearly half of smallholder farmers want a product that gives them a credit or layaway plan to address school fees. This comports with what we know about the smallholder's economic cycle. Income is cyclical with the agricultural cycle, and payments can be due regardless of whether or not any crops are producing and/or generating income at that time.

Smallholders do not place high importance on loans that come with any kind of accounts; less than one-quarter of farmers said this is very important to their agricultural activities (Figure 144). Only single digits of smallholder farmers currently have any of these loans, yet large numbers say they want them (Figure 145).

Desires and Aspirations: Mobile products conjure interest

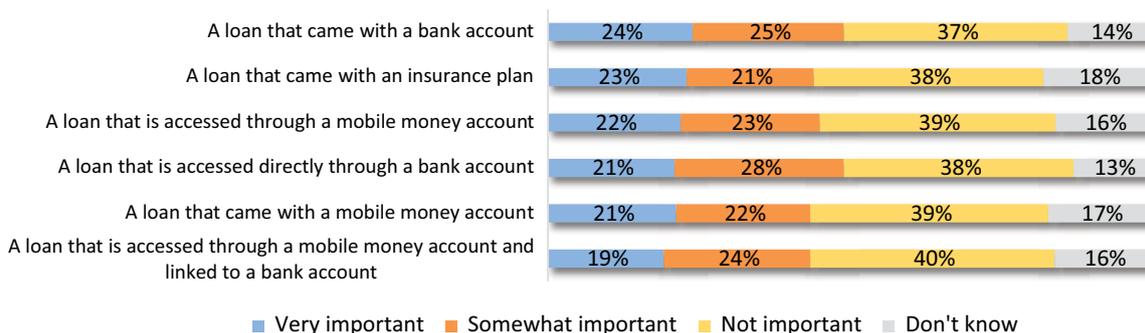
Many smallholder farmers can see the importance in leveraging their mobile phone as a tool for agricultural activities.

FIGURE 143. Do you currently have any of the following products for your agricultural activities? Do you want to have any of the following products for your agricultural activities?



Sample: Smallholder farmers, n=2,771

FIGURE 144. How important is each of the following products to your agricultural activities

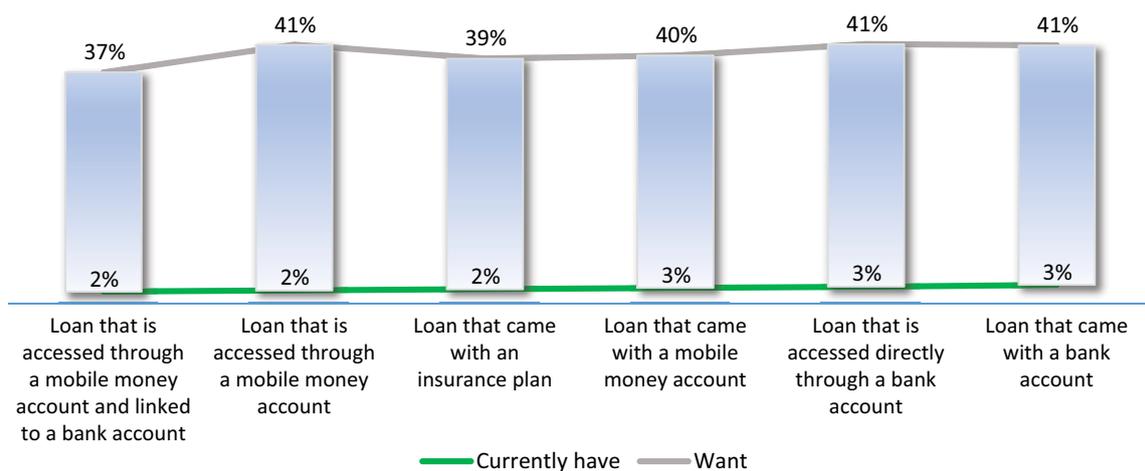


Sample: Smallholder farmers, n=2,771

Half feel it would be very important to use a mobile device to access weather information, and nearly as many said the same about accessing financial services (49 percent) and market pricing for their crops (46 percent) (Figure 146). The only ability that did not rate as high was the ability to track shipments of inputs and crops on a mobile phone.

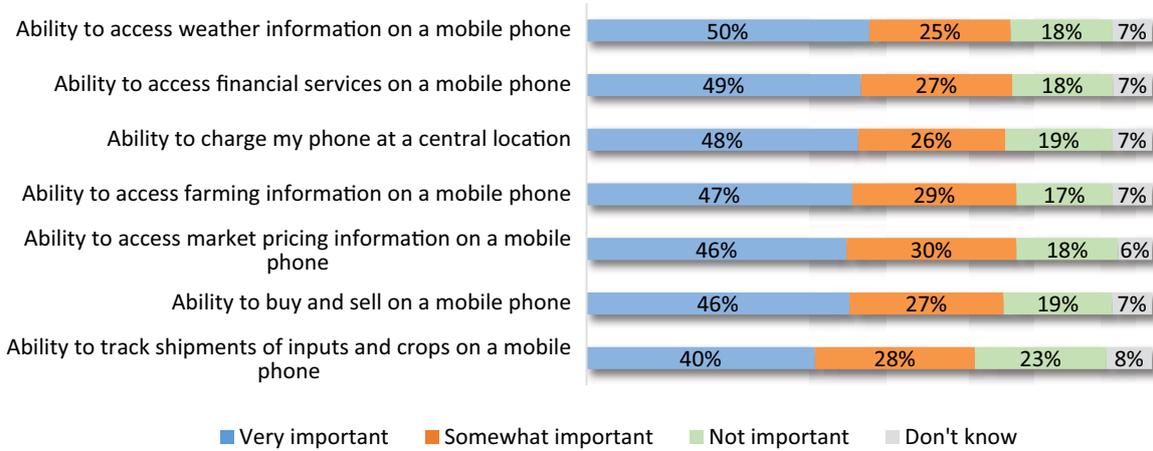
In Uganda, while small percentages have the ability to access information, larger percentages are able to charge their phones at a central location or access financial services (Figure 147). A significant portion—between two-thirds and three-quarters—said they want the ability to do all these actions on a mobile phone.

FIGURE 145. Do you currently have any of the following products for your agricultural activities? Do you want to have any of the following products for your agricultural activities?



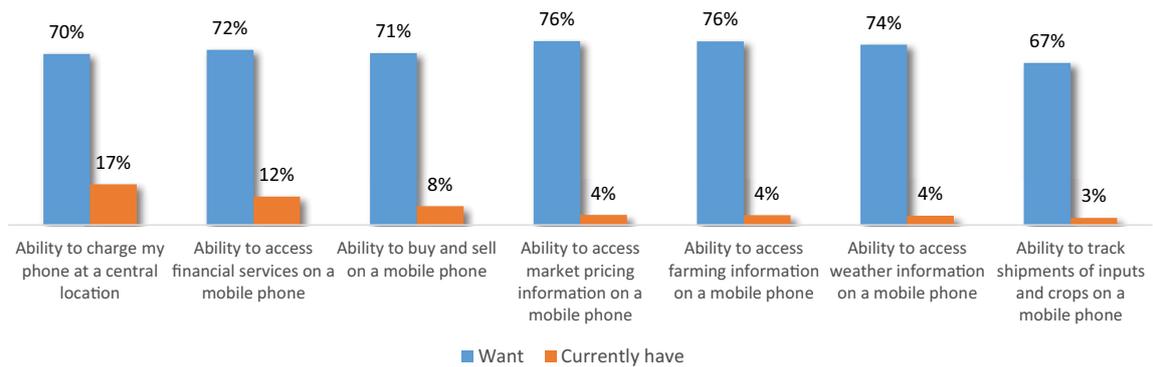
Sample: Smallholder farmers, n=2,771

FIGURE 146. How important is each of the following abilities to your household’s agricultural activities?



Sample: Smallholder farmers, n=2,771

FIGURE 147. Do you currently have any of the following abilities for your agricultural activities? Do you want to have any of the following abilities for your agricultural activities?



Sample: Smallholder farmers, n=2,771

ANNEX 1: METHODOLOGY AND DESIGN

Sample design. The smallholder household survey in Uganda is a nationally representative survey with a target sample size of 3,000 smallholder households. The sample was designed to provide reliable survey estimates at the national level and for the following four administrative regions: Central, Eastern, Northern, and Western regions. The Central region includes central metro (i.e., four municipalities surrounding Kampala), the parishes in Kampala with poultry activity but it excludes Kampala city, which is entirely urban.

A. Sampling Frame

The sampling frame for the smallholder household survey is the list of enumeration areas (EAs) created for the 2014 Uganda National Population and Housing Census. Uganda is divided into 112 districts with each district comprised of counties/municipalities. Each county/municipality consists of subcounties/town councils with each of them being further divided into parishes/wards and villages/cells.

For the 2014 population census, each village and cell was further divided into EAs. Information on the number of agricultural households at the EA level was not available in time for the smallholder survey. As a result, the sample allocation of the survey was based on

the distribution of households by region and by urban and rural strata (Table 14).

B. Sample allocation and selection

In order to take nonresponses into account, the target sample size was increased to 3,158 households assuming a household nonresponse rate of 5 percent observed in similar national households. The total sample size was first allocated to the four regions proportionally to their number of households. Within each region, the resulting sample was then distributed to urban and rural areas proportionally to their size (Table 15).

Given that EAs were the primary sampling units and 15 households were selected in each EA, a total number of 216 EAs were selected (Table 16).

The sample for the smallholder survey is a stratified multistage sample. Stratification was achieved by separating each region into urban and rural areas. The urban/rural classification is based on the 2014 population census. Therefore, eight strata were created and the sample was selected independently in each stratum. Prior to the sample selection, the sampling frame was sorted by the nine agricultural zones called Zardi (Zonal Agriculture Research Development Institute).

In the first stage, EAs were selected as primary sampling units with probability

TABLE 14. Distribution of Agricultural Households by Region, Urban and Rural Strata (2014 Census)

Region	Rural	Urban	Total
Central*	1,284,685	587,901	1,872,586
Eastern	1,436,156	306,514	1,742,670
Northern	1,152,847	171,743	1,324,590
Western	1,575,224	332,606	1,907,830
Uganda	5,448,912	1,398,764	6,847,676

*Central includes Central metro but excludes Kampala

TABLE 15. Sample allocation

Region	Rural	Urban	Total
Central	592	271	864 adds to 863
Eastern	662	141	804 803
Northern	532	79	611
Western	726	153	880 879
Uganda	2,513 (2,512)	645 (644)	3,158 (3,159)

proportional to size, the size being the number of households in the EAs. A household listing operation was carried out in all selected EAs to identify smallholder households according to the definition used in the survey, and to provide a frame for the selection of smallholder households to be included in the sample. In the second stage, 15 smallholder households were selected in each EA with equal probability. Due to rounding, this yielded a total of 3,240 smallholder households.

C. Household listing

The household listing operation was conducted in all selected EAs between 15 July and 7 August 2015. For this purpose, Intermedia developed a manual describing the listing and mapping procedures. This manual was used for the training of 30 listing teams held in Kampala on 11–13 July 2015. Each listing team consisted of one supervisor, one lister, and one mapper recruited from Ipsos' pool of enumerators. The training involved both classroom sessions as well as field practice.

The household listing was done on smartphones and this required IPSOS to develop a script in Dooblo for the listing forms. The script was field tested and validated before it was used for the listing operation.

D. Sampling weights

The sample for the smallholder household survey is not self-weighting, therefore, sampling weights were calculated. The first component of the weights is the design weight based on the probability of selection for each stage of selection. The second component is the response rate at both household and individual levels.

The design weights for households were adjusted for nonresponse at the household level to produce adjusted household weights. Sampling weights for the multiple respondent data file were derived from adjusted household weights by applying to them nonresponse rates at the individual level. For the single respondent data file, the same

TABLE 16. Distribution of the number of EAs by region, urban and rural

Region	Rural	Urban	Total
Central	40	18	58
Eastern	44	10	54
Northern	36	8	44
Western	50	10	60
Uganda	170	46	216

process was applied after taking into account the subsampling done within the household.

Finally, household and individual sampling weights were normalized separately at the national level so the weighted number of cases equalled the total sample size. The normalized sampling weights were attached to the different data files and used during analysis.

E. Sampling error

The sample design for the smallholder household survey is a complex sample design featuring clustering, stratification and unequal probabilities of selection. For key survey estimates, sampling errors taking into account the design features were produced using either the SPSS Complex Sample module or STATA based on the Taylor series approximation method.

Questionnaire Implementation. To capture the complexity of smallholder households, the questionnaire consisted of three parts, with certain questions asked of all relevant individuals in the household, not just one household member (Table 17). In each selected household, a Household questionnaire was administered to the head of the household, the spouse, or any knowledgeable adult household member to collect information about household characteristics. Basic information such as age, gender, education attainment, schooling status, relationship with the household head was collected on all household members. The household questionnaire also collected information on whether each household member contributes to the household income or participates in the household's agricultural activities. This information was later used to identify all household members eligible for the other two questionnaires. Information

on household assets and dwelling characteristics was also collected in order to derive the socioeconomic/poverty status of households. A Multiple-Respondent questionnaire was administered to all adult members in each selected household to collect information on their agricultural activities, financial behaviors and mobile money use. In addition, in each selected household, only one household member was selected using the Kish grid and was administered the Single-Respondent questionnaire.

The questionnaire was translated into nine languages—Acholi, Ateso, Langi, Luganda, Lugbara, Lugishu, Lutooro, Ngakaaramojong, and Runyankole—and then pretested and validated in all languages. Before the start of fieldwork, all three questionnaires were pretested in all languages to make sure that the questions were clear and could be understood by the respondents. At the end of the pretest, debriefing sessions were held with the pretest field staff and the questionnaires were modified based on the observations from the pretest. Following the finalization of questionnaires, a script was developed to support data collection on mobile phones. The script was tested and validated before its use in the field. The questionnaires are found in the user guide accompanying the data set for this household survey.

Main Training, Fieldwork, Data Processing. InterMedia's local field partner conducted the recruitment of interviewers and supervisors for the main fieldwork, taking into account their language skills. Following the recruitment of field staff by InterMedia's local field partner, a centralized training was conducted in Kampala on 3 to 8 August 2015, and included instruction on interview techniques and field procedures, a detailed review of the survey questionnaires, mock interviews between participants in the classroom, and

TABLE 17. Smallholder survey in Uganda: Questionnaire sections, respondents, and content

Questionnaire section	Household respondent(s)	Sample size	Content
1. Household Survey	Head of the household, the spouse, or a knowledgeable adult	n=2,870	<ul style="list-style-type: none"> • Basic information on all household members (e.g., age, gender, education attainment, schooling status) • Information about household assets and dwelling characteristics to derive poverty status
2. Multiple-Respondent Survey	All household members over 15 years old who contributed to the household income or participated in its agricultural activities	n=5,517	<ul style="list-style-type: none"> • Demographics (e.g., land size, crop and livestock, decision-making, associations and markets, financial behaviors) • Agricultural activities (e.g., selling, trading, consuming crops, livestock, suppliers) • Household economics (e.g., employment, income sources, expenses, shocks, borrowing, saving habits, investments)
3. Single-Respondent Survey	One randomly selected adult in the household	n=2,771	<ul style="list-style-type: none"> • Agricultural activities (e.g., market relationships, storage, risk mitigation) • Household economics (e.g., expense prioritization, insurance, financial outlook) • Mobile phones (e.g., use, access, ownership, desire and importance) • Formal and informal financial tools (e.g., ownership, use, access, importance, attitudes toward financial service providers)

a field practice with real respondents in the areas outside the sampled EAs. Five independent field quality control staff (“QC team”), directly hired by InterMedia, also attended the training and participated in the field practice.

Interviewing teams carried out data collection for the survey on mobile phones. Each team consisted of one supervisor and five interviewers. Two

staff members from InterMedia’s local field partner coordinated and supervised fieldwork activities in addition to the QC team hired by InterMedia. The QC team stayed with the survey teams during fieldwork to closely supervise and monitor them. Data collection took place from 16 August to 7 September 2015. During data collection, InterMedia received weekly partial data from the field, which was analyzed for quality

control and used to provide timely feedback to field staff. The final data file was checked for inconsistencies and errors by InterMedia and corrections were made as necessary and where possible.

Response Rates. The questionnaire table below (Table 18) show household and individual response rates for the Uganda smallholder household survey. A total of 3,193 households were selected for the sample, of which 3,101 were found to be occupied during data collection. Of these, 2,870 were successfully interviewed,

yielding a household response rate of 92.6 percent, which is well within acceptable industry parameters for household surveys of this kind. In the interviewed households 5,893 eligible household members were identified for individual interviews. Completed interviews were conducted for 5,517 yielding a response rate of 93.6 percent for the Multiple-Respondent questionnaire. Among the 2,870 selected for the Single-Respondent questionnaire, 2,771 were successfully interviewed corresponding to a response rate of 96.6 percent.

TABLE 18. Response rates for Household, Multiple-Respondent, and Single-Respondent questionnaires

Response Rates by Region and Urban-Rural							
	Central	Eastern	Northern	Western	Urban	Rural	Total
<i>Household questionnaire</i>							
Household selected	865	806	635	887	672	2,521	3,193
Households occupied	817	791	618	875	639	2,462	3,101
Household interviewed	714	744	581	831	556	2,314	2,870
Household response rate	87.4%	94.1%	94.0%	95.0%	87.0%	94.0%	92.6%
<i>Multiple-Respondent questionnaire</i>							
Number eligible	1,417	1,691	1,189	1,596	1,116	4,777	5,893
Number of eligible interviewed	1,225	1,605	1,124	1,563	1,014	4,503	5,517
Response rate	86.5%	94.9%	94.5%	97.9%	90.9%	94.3%	93.6%
<i>Single-Respondent questionnaire</i>							
Number eligible	714	744	581	831	556	2,314	2,870
Number of eligible interviewed	662	724	563	823	525	2,246	2,771
Response rate	92.7%	97.3%	96.9%	99.0%	94.4%	97.1%	96.6%

ANNEX 2: RANDOM FOREST ALGORITHM

A Random Forest consists of a collection or ensemble of simple tree predictors, each capable of producing a response when presented with a set of predictor values.⁴² For classification problems, this response takes the form of a class membership, which associates, or classifies, a set of independent predictor values with one of the categories present in the dependent variable. Alternatively, for regression problems, the tree response is an estimate of the dependent variable given the predictors. The Random Forest algorithm was developed by Leo Breiman and Adele Cutler.

A Random Forest consists of an arbitrary number of simple trees, which are used to determine the final outcome. For classification problems, the ensemble of simple trees vote for the most popular class. In the regression problem, their responses are averaged to obtain an estimate of the dependent variable. Using tree ensembles can lead to significant improvement in prediction accuracy (i.e., better ability to predict new data cases).

Technical Details

The response of each tree depends on a set of predictor values chosen independently (with replacement) and with the same distribution for all trees in the forest, which is a subset of the predictor values of the original data set. The optimal size of the subset of predictor variables is given by $\log_2 M + 1$, where M is the number of inputs.

For classification problems, given a set of simple trees and a set of random predictor variables, the Random Forest method defines a margin function that measures the extent to which the average number of votes for the correct class exceeds the

average vote for any other class present in the dependent variable. This measure provides us not only with a convenient way of making predictions, but also with a way of associating a confidence measure with those predictions.

For regression problems, Random Forests are formed by growing simple trees, each capable of producing a numerical response value. Here, too, the predictor set is randomly selected from the same distribution and for all trees. Given the above, the mean-square error for a Random Forest is given by:

$$\text{mean error} = (\text{observed} - \text{tree response})^2$$

The predictions of the Random Forest are taken to be the average of the predictions of the trees:

$$\text{Random Forest Predictions} = \frac{1}{K} \sum_{k=1}^K K^{\text{th}} \text{ tree response}$$

where the index k runs over the individual trees in the forest.

Typically, Random Forests can flexibly incorporate missing data in the predictor variables. When missing data are encountered for a particular observation (case) during model building, the prediction made for that case is based on the last preceding (nonterminal) node in the respective tree. So, for example, if, at a particular point in the sequence of trees, a predictor variable is selected at the root (or other nonterminal) node for which some cases have no valid data, then the prediction for those cases is simply based on the overall mean at the root (or other nonterminal) node. Hence, there is no need to eliminate cases from the analysis if they have missing data for some of the predictors, nor is it necessary to compute surrogate split statistics.

42 See documentation on Random Forest Algorithm at <http://www.statsoft.com/Textbook/Random-Forest>.

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