APPLYING SYSTEM MAPPING AND MEASUREMENT TO AGRICULTURAL FINANCE
UNDERSTANDING SMALLHOLDER ACCESS TO FINANCE

INTRODUCTION

The USAID/Uganda Feed the Future Market System Monitoring Activity (MSM) applies principles from systems engineering and supply chain management to develop methodologies and tools that can be used to understand, monitor, and adapt to systemic change. The primary, and most powerful of these tools is the system map, which helps practitioners to conceptualize their work as part of a system - an interconnected network of actions and conditions that interact dynamically to generate the system's behavior.

System maps can be used to represent the complex interactions among actors in a system, and to identify the conditions, relationships, or incentives that must be in place in order to encourage desired changes in the system state. Though many insights can be gathered from a system map itself, it is more powerful when relevant data are layered onto the map to display indicators and measure system status: the map then becomes a visual and dynamic representation of the health of the system.

This case study demonstrates how system mapping and measurement tools can generate new insights into complex topics, using agricultural finance in Uganda as an example. System maps can be a powerful decision tool, and this case study demonstrates how they can be used to characterize the dynamics of a particularly complex sector, collect and make sense of diverse data, and visually represent that sector's overall "health".

The analysis unearthed three overarching results or "stories" about smallholder farmers' access to finance for agriculture. The remainder of the case study explains how these insights were generated with system mapping and measurement.

1) **Physical access to formal loans is limited but improving**

   Physical access to formal loans has improved with the expansion of mobile money and the introduction of agent banking. However, mobile money loans are not tailored for agriculture, and most banking agents are still located in urban areas. As such, physical access to formal loans remains limited by access to rural bank branches, and as of 2017 only 30% of rural Ugandans lived within 5km of a bank branch, bank agent, MFI, and/or ATM.

2) **Informal loans are widely available**

   Informal loans are more widely available: more than a third of farmers belong to savings groups, more than half live near a savings group, and many more have family and friends they can turn to for assistance. Rural Ugandans largely prefer borrowing within their community or from local institutions. However, informal loans still may not be appropriate for agricultural lending, depending on the size of the loan available and the timing of loan repayments.

3) **Demand for agricultural loans is low**

   Despite relatively widespread access to loans (in 2018, 48% of rural adults had accessed

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credit in the previous 12 months), demand for *agricultural* loans remains low – fewer than 5% of rural Ugandans reported taking out loans for agricultural purposes. The data suggest that although rural Ugandans understand the importance of investing in agriculture, the majority either do not feel they need a loan or do not want to take the risk: as many as 77% of rural Ugandans reported that they avoid borrowing if they can.

BACKGROUND

Access to finance is seen as essential to improving the productivity (and therefore the living standards) of smallholder farmers across sub-Saharan Africa. Farmers can use credit or loans to rent land for production, to purchase inputs such as improved seeds and fertilizer, and eventually to invest in capital goods such as tractors or irrigation equipment. Unfortunately, the use of agricultural finance in Uganda is currently very limited. Although 80% of rural Ugandans are engaged in agriculture, and an estimated 80% of farmers are smallholders[1], in a recent survey only 4.4% of rural Ugandans reported taking out a loan for farming/fishing purposes.[2]

Given that agricultural finance has the potential to be a key driver of agricultural productivity and economic growth in Uganda, USAID/Uganda was interested in understanding **why so few farm households have accessed credit for agricultural purposes**. A system map was created in order to help answer this question, by pinpointing the actions and conditions that are either enabling or preventing smallholder farmers from accessing credit. The team determined the key outcome of the agricultural finance sector to be "Farmers take out loans to improve farming practices", as this was the primary knowledge gap identified by USAID.

The Agricultural Finance System Map was developed through an iterative, consultative process. As is often the case for our deep-dive studies, our team consulted the Uganda Agricultural Market System Map[3] as a starting point for developing a more in-depth map, using its Financial and Business Services subsystem (which had already been validated by stakeholders), as the jumping-off point. Our team consulted published literature, white papers, and other relevant resources, and a team member based in Uganda engaged with multiple stakeholders across the agricultural and financial sectors. We consulted with agriculture insurance companies, formal financial institutions (banks, microfinance institutions, etc.), NGOs, and local academic experts, as well as experts at USAID/Uganda. Our team also conducted a "field" visit to Mbale district in eastern Uganda to meet with system actors providing rural finance as well as smallholder farmers. All of these resources allowed us to develop what we believe is the most accurate and comprehensive map of the agricultural finance sector of Uganda.

Once the completed map had been validated by local stakeholders, the MSM team added indicators to the map, in order to measure the status of the constituent elements and create an approximate picture of system health. Our team canvassed a wide range of publicly available data sources, including large panel datasets (e.g. the Global Findex Database and FinScope Surveys), journal articles, technical reports, and news articles. We identified more than 100 sources that contained relevant information. If we were unable to find an adequate data point in the publicly available data

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[1] National Planning Authority. "Policy Paper on Transforming Smallholder Farming to Modern Agriculture in Uganda." 2013. http://npa.go.ug/wp-content/uploads/2018/04/NPA-PEC-PAPER-TRANSFORMING-SMALLHOLDER-FARMING-TO-MODERN-AGRICULTURE-IN-UGANDA.pdf

[2] FSD Uganda. "FinScope Uganda 2018 Dataset." 2018. http://catalog.data.ug/dataset/finscope-2018

[3] Available at https://kumu.io/MSM/usaid-uganda-ftf-msm-activity-agricultural-market-system-map

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for a particular element and could not identify an appropriate proxy, we considered the element as unmeasured. We did not collect our own data for this study, meaning that many elements were deemed "out of scope" for this analysis.

For each map element, our goal was to find data that measured the element's "extent of adoption", such as the number of farmers with a bank agent or bank branch nearby or the number of farmers who use mobile money. Extent of adoption is measured as the extent to which a behavior/relationship has been adopted by system actors, or the strength of saturation of a particular system condition. We use the extent of adoption as the ideal measurement for each element because market facilitation interventions often focus on promoting behavior change or relationship development, both of which can be understood by looking at the extent to which system actors have adopted a particular practice – and this generic measurement approach enables all the data to be displayed on a common scale, even if it comes from different sources.

The team sought to use as few sources as possible across the map, to maximize comparability between elements and minimize variation caused by differing survey samples or time periods. Overall, our team was able to create a series of indicators for two time periods, 2017-18 and 2013-14. The majority of the data were drawn from the 2013 and 2018 FinScope surveys and the 2013 and 2017 Digital Pathways to Financial Inclusion Surveys. Both surveys were administered to approximately 3,000 respondents and are weighted to represent the entire adult population of Uganda. Both datasets also specified whether respondents lived in rural or urban areas, allowing our team to calculate statistics specifically for the rural population. Of the 72 variables in the diagram, we were able to measure 37 indicators for the 2017-18 snapshot and 34 indicators for the 2013-14 snapshot with publicly available data. (The metadata indicating which data source and survey question were used to measure each map element are provided within Kumu.)

We were unable to create indicators for 35 variables for 2017-18 and for 38 variables for 2013-14. These primarily included the behaviors or practices of formal financial institutions and insurance companies, which do not make information publicly available. We were able to infer a status for six of these elements, based on the status of the elements that enable them (these are primarily 'summary' elements, which represent the collective effect of multiple pathways, such as "Farmer has physical access to formal loan")

Where one or more data points were available for a particular map element, the team created an indicator to measure the status of that element. Based on the percentage extent of adoption, an element is then shaded red, yellow, green, gray, or left white. We chose consistent cutoffs for the colors: red indicates 0%-32% adoption, yellow indicates 33%-66% adoption, and green indicates 67%-100% adoption. Gray indicates those elements which we could not measure using publicly available data (even though the data may be privately held, e.g. by banks or businesses), and white indicates those for which we tried to find data but were unsuccessful and could not infer a status. Elements that could be inferred based on the elements that enabled them are filled with a lighter-colored background and a thick outline.

For a more in-depth treatment of the methodology used to conduct this analysis, we invite you to read the journal article that describes this study, *A Systems Framework for International Development: The Data-Layered Causal Loop Diagram.*[4] To learn more about our team's system mapping and measuring tools, we invite you to explore the System Pathways Toolkit, which was created by the MSM Team as a primer for applying systems thinking to your particular field or

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[4] Blair, C., et al. "A Systems Framework for International Development: The Data-Layered Causal Loop Diagram." *Production and Operations Management* (2021), https://doi.org/10.1111/poms.13492

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context. Please visit https://humanitarian.mit.edu/project/feed-the-future-uganda-market-systems-monitoring/ to access the toolkit along with the other tools and research produced by the MSM Activity, or contact the Activity at msm.uganda@mit.edu.

All of the figures in this report were created from the online version of the map, developed using the Kumu platform (found here: https://kumu.io/MSM/usaid-uganda-ftf-msm-activity-agricultural-finance-system-map#full-map). We highly recommend that you have the map open in Kumu while you read this report. Kumu allows you to zoom in on components of the map, and access extensive metadata. Please see our *Introduction to System Mapping in Kumu* guide (found here: https://dspace.mit.edu/handle/1721.1/131193) for more information about how to navigate the system map using Kumu.

RESULTS

Result 1: Physical Access to Formal Loans is Limited but Improving

One of the key pathways to access to finance is physical access to formal loans. The Formal Access Pathway has "red/pink" arrows on the system map and is shown in isolation in Figure I below. Much recent attention by development actors has been on improving access to loans from formal financial institutions (banks and microfinance institutions). After analyzing the map, it is clear that although much progress has been made, **formal loans remain widely inaccessible**.

The Formal Access Pathway (see Figure 1) includes the two main channels through which farmers have physical access to formal loans: via bank branches/agents and mobile money. First, we examine physical access via bank branches/agents. Bank branches are notoriously inaccessible in rural areas (where the majority of the population lives) - only 30% of rural Ugandans live within 5km of a bank branch, bank agent, MFI, and/or ATM (as of 2017-18, up from 24% in 2013-14), so "Bank Agent or bank branch nearby" is shaded red in the map. This 6% increase suggests that bank branch availability has not been prioritized.
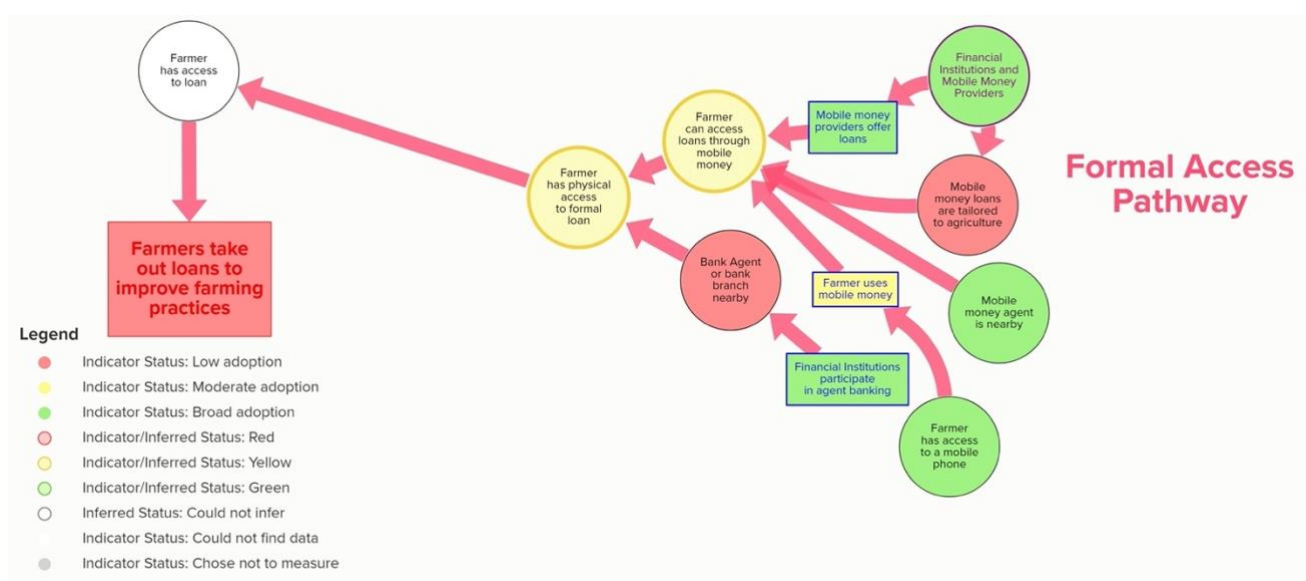
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Figure 1: The Formal Access Pathway from the system map

However, financial institutions have been working to improve physical access to loans via agent banking, through which local businesses are appointed to provide banking services on behalf of a commercial bank. Agent banking was introduced to Uganda in 2017, and has steadily been permeating into the banking system, with most of the major players in the commercial banking sector participating (thus, the related element is shaded green in the map). Unfortunately, as of 2020, most bank agents were located in urban centers. This branch of physical access is thus, for the time being, not widely available, but shows promise for the future. Agent banking will facilitate the expansion of physical access to financial services without requiring the construction of bank branches, as banks establish relationships with existing businesses in rural communities to offer financial services. We expect to see formal access improve in the coming years as banking agents expand to more rural areas.

Mobile money serves as the other access point for formal loans, and its availability is widespread. The majority of rural Ugandans now have access to mobile money: as of 2017, 79% of rural Ugandans had a mobile money agent within 5km of their home, and 78.2% reported having access to a mobile phone. As seen in Figure 1, both "Farmer has access to a mobile phone" and "Mobile money agent is nearby" are shaded in green. However, "Farmer uses mobile money" is shaded yellow: only 54.3% of rural Ugandans reported using mobile money for any financial activity in 2017. Nevertheless, this figure increased from 38.2% in 2013, suggesting that usage rates could continue to rise over the next few years.

Despite growing use of mobile money, there is still a barrier to accessing loans for agriculture. Loans are available through mobile money, with MTN and Airtel (which together represent almost 100% of mobile money accounts) both offering loans through their platforms as of 2017. However, the loans that are offered on mobile money platforms are not suitable for agricultural purposes, due to their short repayment periods. As seen in Figure 1, "Farmer can access loans through mobile money" is shaded yellow – although mobile money providers offer loans, they are not tailored to agricultural purposes. Nevertheless, given the popularity of mobile money, it is possible that mobile money providers will begin offering more loan products that are tailored to agriculture.

Overall, the Formal Access Pathway saw more change in the five year period from 2013-14 to 2017-18 than any other pathway on the map. This is shown in Figure 2, where a darker blue color indicates greater change. This is driven by the expansion of mobile money and the introduction of agent banking. We can see from this result that formal financial institutions are seeking to expand by "piggybacking" off of existing networks, through mobile money loans and agent banking, rather than prioritizing investment in new bank branches. This strategy minimizes the cost of expanding access to rural areas, and suggests that although physical access currently remains limited, we should expect this to improve over the coming years.

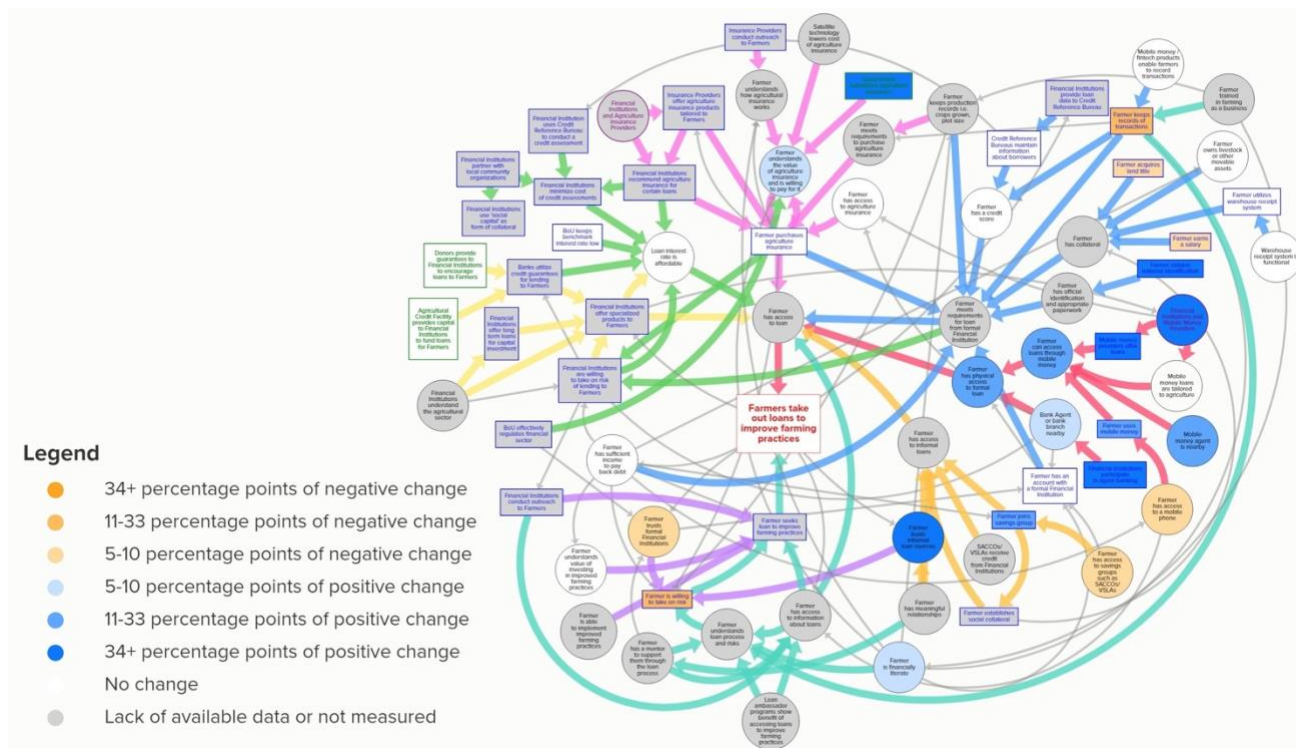# UNDERSTANDING SMALLHOLDER ACCESS TO FINANCE

Figure 2: A version of the system map showing the change in element status from 2013-14 to 2017-18

Result 2: Informal Loans are Widely Available

There appears to be much **more widespread access to loans via informal loan sources** (SACCOs, VSLAs, community lending, etc.) than via formal institutions. The element data on the informal financing pathway (shown in Figure 3) indicates that farmers are better able to meet the requirements for informal loans (80% have social collateral, more than a third are members of savings groups) and physical access is much less constrained (more than 50% live near a savings group; many more can turn to family and friends). Rural Ugandans also largely prefer to seek financing within their community: 82% of rural respondents in one survey reported that they feel most confident borrowing money from family members, friends, savings groups/VSLAs, money lenders in their community, or SACCOs.

Despite the ease of access, informal loans may also not be appropriate for agricultural investment. There may still be issues with loan repayment timing (both in the time before payments must begin and the amount of time provided to repay the loan) as well as the size of the loan that is available to the farmer. Affordability is likely less of an issue, though limited data constrains concrete conclusions. In sum, there are fewer constraints on access to informal loans and much more widespread access among rural Ugandans.

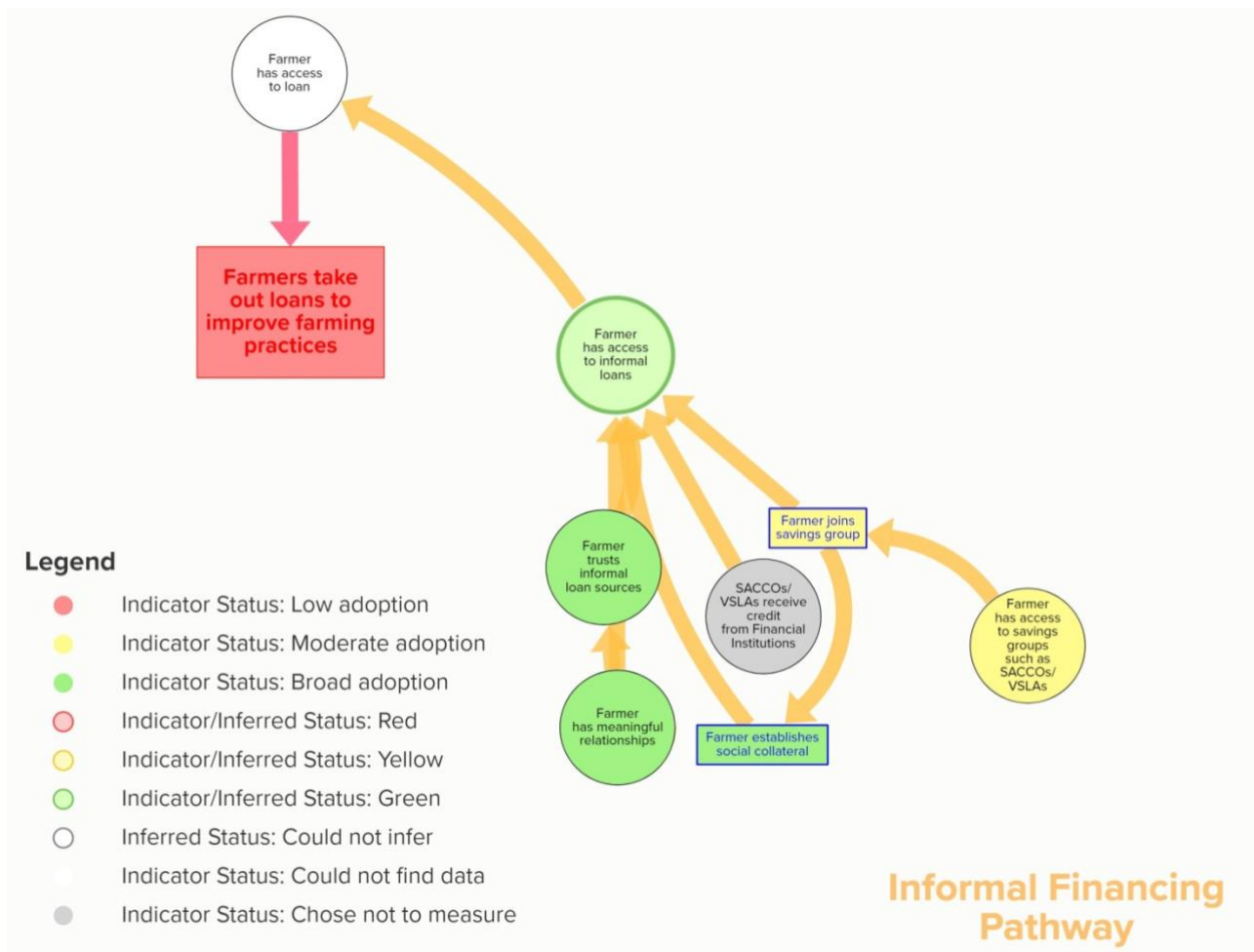# UNDERSTANDING SMALLHOLDER ACCESS TO FINANCE

Figure 3: The Informal Financing Pathway from the system map

RESULT 3: DEMAND FOR AGRICULTURAL LOANS IS LOW

The results above indicate that access to loans for agricultural investment is limited but improving, and in particular, that a substantial proportion of farmers have access to informal loan sources. Indeed, the data shows that rural Ugandans are able to access credit: the 2018 FinScope Survey found that 48% of rural adults had accessed credit in the previous 12 months, and over 90% reported having borrowed from informal lenders or family and friends. However, very few rural Ugandans report taking out loans for agricultural purposes: fewer than 5% in both 2013-14 and 2017-18. Access, then, cannot be the only barrier to agricultural financing.

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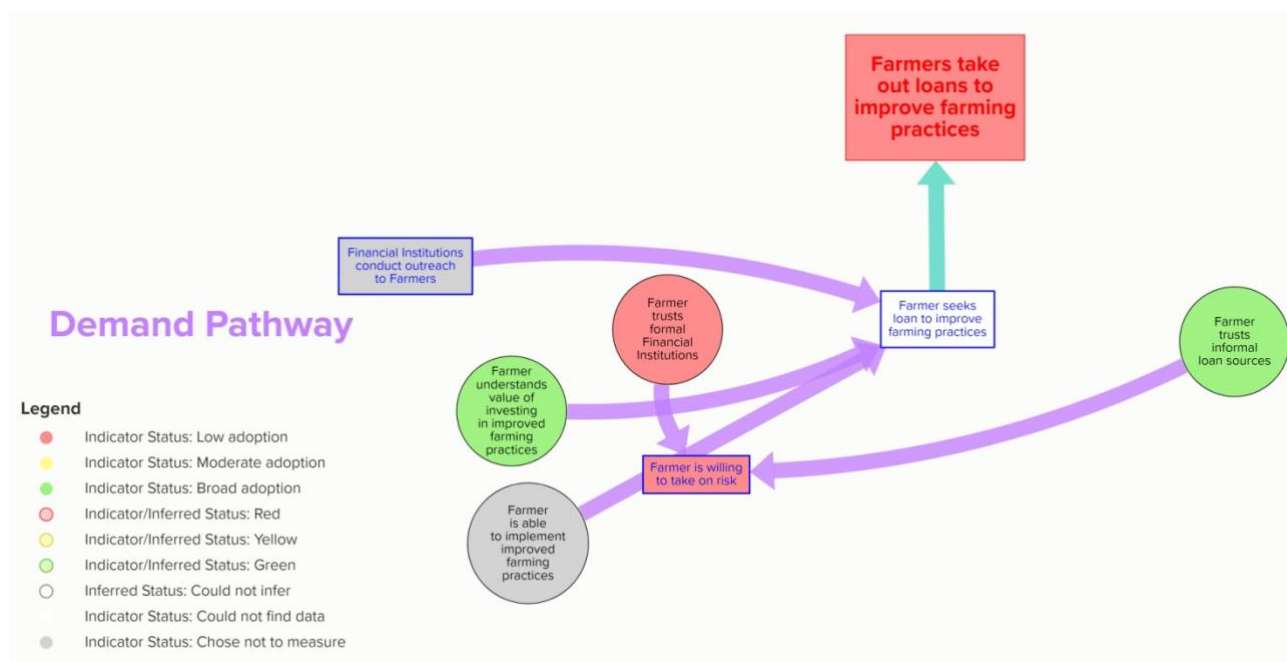
Figure 4: The Demand Pathway from the system map

To gain more insight into additional barriers to loan usage, we examined a question from the 2018 FinScope Survey, in which households that had not borrowed in the previous 12 months were asked the main reason why they had not sought out a loan. Though the use of the phrase "main reason" limits our insight into the full set of influencing factors, the results are still instructive. The most commonly cited reason was the household's concern about its ability to repay the loan (42.7% of respondents who did not borrow). The second most common response (21.7%) was that the household either did not want to borrow or did not believe in borrowing, and the third most common response (19.2%) was that the household had sufficient income and did not need to borrow money. Together, these responses indicate that **83% of rural Ugandans felt they did not need a loan or were not interested in taking the risk**. This implies that the low number of agricultural loans in Uganda is at least partly due to a lack of interest or demand. Another interesting takeaway is the discrepancy between the survey responses and the reasons that are most commonly cited in the literature regarding demand for loans. Many of the commonly cited barriers relate to high interest rates, lack of collateral or credit score, and lack of knowledge on lending, yet fewer than 10% of respondents collectively chose these reasons as their main reason not to get a loan.

These data and preliminary conclusions correspond to what was found on the demand pathway (seen in Figure 4) of the system map, which indicates that a lack of demand for credit is a major influence on the number of loans accessed by farmers. Most households seem to understand the value of investing in farming – in a 2015 survey, 79% of respondents said it was "very important" for their household to invest money in a farm. However, few are willing to take on the perceived risk of a formal or informal loan: as many as 77% of rural Ugandans reported in 2018 that they avoid borrowing if they can.

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CONCLUSION

System maps can be invaluable tools for organizing and visualizing data. As demonstrated here, adding data to the system map for agricultural finance made it easier to identify three important insights about the system, based on the status of key pathways. The data overlaid on the map was particularly critical in showing that physical access to loans was not, as many assumed, the primary barrier to greater uptake of agricultural loans. The map showed moderate and increasing access, yet loan uptake had not increased accordingly. Overlaying diverse data sets on a depiction of causal pathways was critical to noticing and "debunking" this commonly held assumption. The map could further be used to identify barriers to change and potential areas for investment, both of which serve to generate actionable recommendations for development practitioners to achieve various key system outcomes.