Lessons From Deploying the Remote Transaction System With Three Microfinance Institutions in Uganda

Matthew Kam
Department of Electrical Engineering and Computer Sciences, and
Berkeley Institute of Design
University of California, Berkeley
387 Soda Hall #1776
Berkeley, CA 94720-1776
mattkam@cs.berkeley.edu

Tu Tran
School of Information Management and Systems
University of California, Berkeley
102 South Hall #4600
Berkeley, CA 94720-4600
tutran@sims.berkeley.edu

OBJECTIVE

An estimated 500 million economically active poor people throughout the world operate micro-enterprises and could benefit from micro-credit and related financial services. Most of them do not, however, have adequate access to these services (Women's World Banking 1995). The Remote Transaction System (RTS) is a combination of technology and recommended business processes spearheaded by the Microdevelopment Finance Team (MFT)[1] that aims to provide a viable means for helping microfinance institutions scale operations and reach more rural customers in an affordable and sustainable manner.

The authors of this paper spent three weeks in the summer of 2004 to observe the first phases of the RTS technology rollout in Uganda. Despite the technical expertise, business experience and sponsorship behind the RTS, the challenges in developing a new technology solution for this environment, testing it, and implementing the system in three microfinance institutions having different operational structures resulted in a number of unanticipated obstacles and challenges. This paper aims to draw lessons from the RTS team's experience that can inform how delivery channel systems could be more smoothly developed, implemented, and deployed to support microfinance and other applications.

BACKGROUND AND PROBLEM STATEMENT

Microfinance institutions (MFIs) provide small loans to low-collateral individuals who are

not traditionally serviced by mainstream financial institutions. These loans, known as micro-credit, provide recipients with capital to start or operate small businesses. Although micro-credit borrowers are not typically serviced by commercial banks, they seem not to pose a higher credit risk vis-à-vis other borrowers. In fact, some of the most successful microfinance institutions report repayment rates as high as 98 percent (Grameen Bank 2004).

Many believe that the microfinance industry has been successful in breaking the cycle of poverty for many people in developing countries. Grameen Bank, one of the prominent and influential leaders of the microfinance industry, reports that the average household income of Grameen Bank members is about 25 percent higher than for non-members in villages with Grameen branches. In addition, only 20 percent of Grameen members live below the poverty line, compared with 56 percent for comparable non-Grameen members (Grameen Bank 2004).

As part of a recent study on non-government organizations (NGOs) in Uganda (Barr et al. 2003), researchers conducted group interviews with approximately 2,500 respondents in potential NGO recipient communities. When groups were asked about the needs that they perceived for their communities, "credit" was the fourth-most mentioned response, after health care, clean water, and education for children. "Credit" was mentioned by 68% of respondents. In the same set of interviews, 62% of the groups, which is a higher proportion than any other cited needs, indicated that NGOs

[1] The Microdevelopment Finance Team was established in August 2002. Members include Accion International, BizCredit, echange LLC, Freedom from Hunger, FINCA International , Grameen

were involved in meeting their communities' need for credit. There thus appears to be a significant need for microfinance in Uganda.

Despite the success of microfinance in lifting people from the poverty line, the microfinance institution's reach is still limited to mainly urban and peri-urban areas, largely because of high transaction costs, high levels of inefficiency and insufficient number of experienced managers to support the needs of the industry. In order to extend the reach of microfinance services to rural areas, and thus increase client outreach, some microfinance institutions are considering the integration of new forms of information and communication technology to:

- Reduce client costs of accessing micro-credit services, such as time and monetary costs of traveling to meetings or branches
- Raise the productivity of microfinance institutions
- Transition from manual record-keeping to standardized electronic client data
- Obtain timely, accurate client and group information for the microfinance institution's accounting and reconciliation processes

The last two measures above establish the requisite institutional reporting structures for attracting more commercial funding. In this manner, microfinance institutions and their clients can further reduce their reliance on donor funding and raise their credit worthiness, respectively, while fostering greater sustainability for both.

The goal of the RTS solution is to enable microfinance institutions to achieve these objectives while also extending microfinance to rural and peri-urban areas, where they

have previously been unable to reach due to the costs associated with providing microfinance services. The device that goes into the field is portable and battery-operated, with more than 12 hours of battery life, which allows it to be taken much closer to clients' homes and businesses.

STUDY SETTING

The Remote Transaction System (RTS) is a solution being deployed in Uganda as a part of a pilot project spearheaded by the Microdevelopment Finance Team (MFT) to improve access to microfinance services. The passing of the Microfinance Deposit-Taking Institutions (MDI) Act in Uganda in 2003 influenced the decision to conduct the pilot in Uganda. Specifically, the MDI Act permits MFIs to mobilize savings deposits from their clients. Introducing the RTS into an environment that was undergoing regulatory change provided an added benefit to the subsidiaries of two affiliates of MFT members. At the time of this writing, one of the MFIs participating in the RTS pilot had received the license to mobilize savings deposits from clients, while another MFI in the pilot is awaiting approval.

The MFT is a public-private sector consortium of microfinance leaders, technology specialists and business thinkers convened by Hewlett-Packard in August 2002. At the time of writing, the members of the MFT include: ACCION International, Bizcredit, FINCA International, Freedom from Hunger, echange, Grameen Foundation USA, Hewlett-Packard Company and PRIDE Africa. The mission statement of the MFT is "to

champion a breakthrough in the effectiveness, relevance and scale of microfinance services to the world's urban and rural poor."[2]

The RTS solution is a combination of technology and recommended business processes intended to create new business models and relationships for microfinance institutions, clients (i.e. borrowers) and agents. Three different deployment strategies are being tested in the Uganda RTS pilot, which we describe below in the "Business Models" sub-section.

Technology Overview

At the front-end (which clients experience) the technology solution comprises a point-of-sales device equipped with a smartcard reader, that has a printer for generating receipts, and cellular networking capabilities, as well as software developed for the device. At the back-end, the RTS includes an RTS server that captures and retains all point-of-sale transactions, connectors to the MFI's management information system (MIS), and the MIS and accounting systems of each participating institution. Each client or client group uses a smartcard and personal identification number (PIN) to authenticate and authorize transactions, which could be loan repayments, savings deposits, savings withdrawals, account transfers and balance lookups. The point-of-sale devices are managed by MFI agents, who can be either field officers, branch tellers, or independent third-party merchants, depending on the business model.

[2] MFT's "Microfinance Problem Statement," October 8, 2002.

In the original design, the system was built to support both online and offline transactions. Online transactions require real-time cellular connectivity that allows for instantaneous transmission of data from the point-of-sale device through the RTS servers and connector directly to the MFIs' MIS servers. Offline transactions, on the other hand, do not require real-time connectivity. Rather, a number of transactions are "batched" on the point-of-sale device to be uploaded later in the day when cellular coverage is available, hence eliminating the requirement for connectivity for each transaction.

Preliminary field investigations and the fact that 85% of Uganda has cellular coverage[3] led the design team to the initial assumption that online transactions would be dominant. After the authors left Uganda, however, the pilot team learned that the cellular providers downgrade data calls when the cellular infrastructure is congested, leading to much lower rates of connectivity than expected. The RTS team also learned that group meetings were more efficient when transactions are performed in a fully offline mode. As a result, the RTS team has re-engineered the solution to a primarily offline solution. According to the pilot team, the new version of the RTS that is optimized for offline transactions for both group and individual client business models will be deployed in February 2005.

A local applications service provider (ASP) provides the server hosting and technical support for the wireless network connectivity between the devices and backend servers located at the MFI headquarters.

Figure 1 shows the devices and subsystems that make up the overall RTS technology.

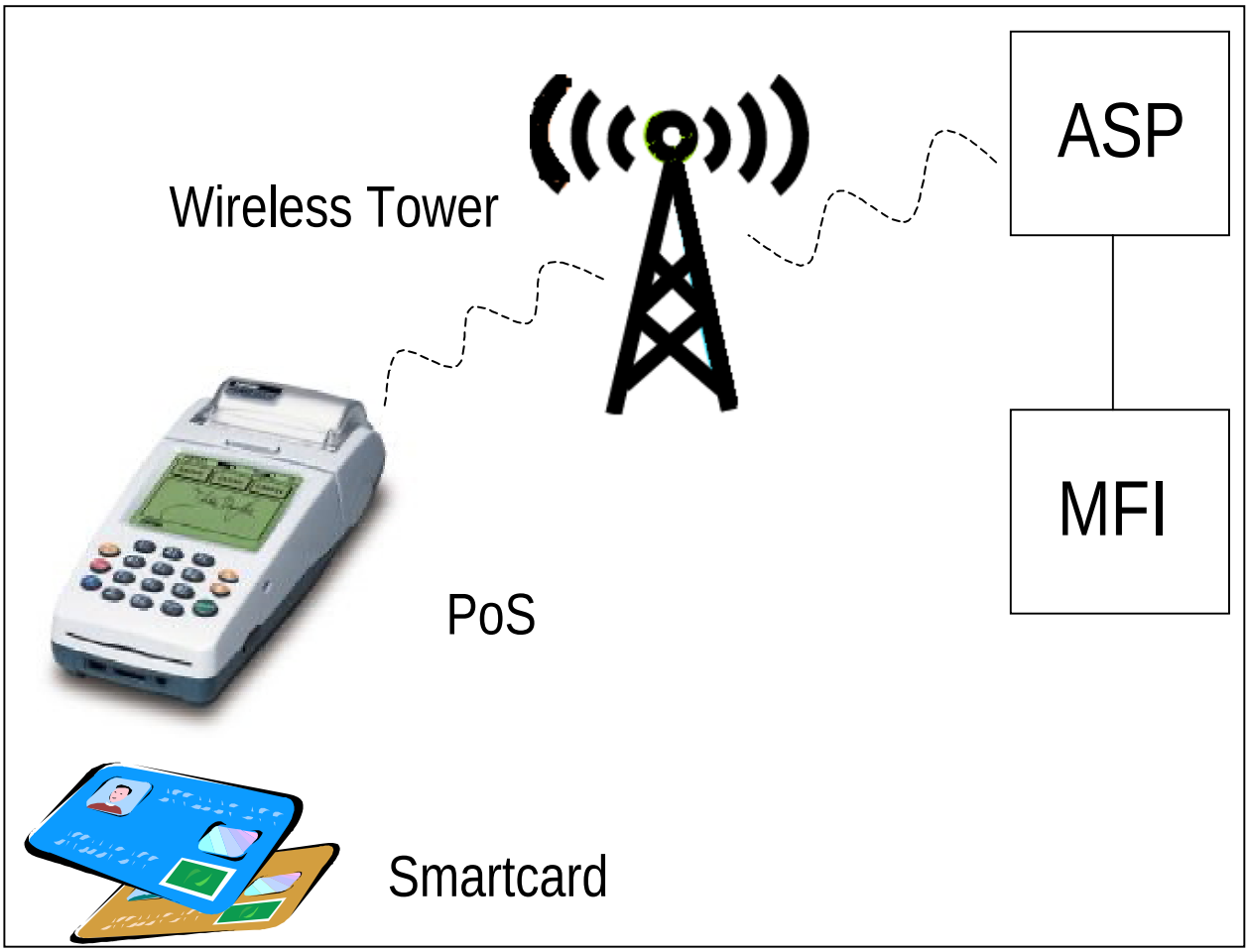

Figure 1: The sub-systems that make up the overall RTS technology for each MFI.

Each MFI in the pilot had its own RTS server and MIS server as well as a unique connector between the two servers. Each connector makes communications between its respective RTS server and MIS server possible. The ASP in this figure hosts the above servers and connector for every participating MFI.

In a typical scenario, both a client and MFI agent authenticate themselves using their smartcards. Both parties next complete a transaction such as a loan payment on the point-of-sale device. In the third-party agent model, payments are made between the client and a merchant, who is independent of the MFI. Cash is exchanged between the client and the independent agent when transaction details are entered into the point-of-sale device. Funds are then reconciled at the back-end at the end of the day. In the other two models, transaction information is also entered into the point-of-sale device, but funds are taken to the bank by a group representative in exactly the same way as they were before the introduction of the RTS.

[3] As indicated by local cellular providers and infrastructure support companies.

Business Models

The following three different business models were tested in the RTS pilot with three respective MFIs:

- **The Field Officer Model**: Field officers take the point-of-sale device to bi-weekly client meetings and capture transactions electronically. The MFI for this model practices group lending. The institution was moving from tracking payments at the group level to tracking payments at the individual level. This represents an enormous technical and logistic change for the MFI. With the RTS, individual clients possess smartcards and transact with the point-of-sale device individually. The RTS can therefore track information for the MFI at both the individual and group level. Data from the point-of-sales device is uploaded to the server either remotely after a group meeting or at the branch office later that day. Since the MFI is transitioning to a dramatically expanded data collection method, the expected benefits of the RTS for the MFI include simplified data collection, improved data quality, and reduced transaction costs, as well as faster reconciliation, which enables improved risk management, faster responses to collection, and improved liquidity management. It is expected that clients will have greater transparency with their MFI and increased levels of information about their loans and savings balances.
- **The Remote Branch Office Model**: This MFI also practices group lending. The RTS is being piloted at a remote sub-branch that was built by the MFI to reach their rural clients more effectively. Two days a week, MFI staff travels to the branch to accept loan payments and savings deposits from group leaders. In the RTS pilot,

each loan group will possess a smartcard, and a group representative performs the point-of-sale transactions for the group at the remote branch office. The RTS will track data at the group level. The expected benefit of the sub-branch for this institution's clients is reduced time, travel, and opportunity costs associated with making loan transactions. The expected benefits of the RTS for the MFI include improved data quality, increased operational efficiency, and improved liquidity management. If desired, this MFI could also begin to use the RTS solution to track information at the individual client level at some point in the future.

- **The Third-Party Agent Model**: This institution is seeking to reduce their operating costs, establish branchless banking, and achieve sustainable rural outreach. This MFI is engaging its larger, more established clients as managed, independent agents. These agents will offer loan payment, savings deposit, and eventually savings withdrawal services to the MFI's clients, at a fee, using the point-of-sale device. This MFI offers individual loans, although individuals are organized into solidarity groups for accountability purposes and risk management. In the RTS pilot, each participating client will possess a smartcard. Data is tracked at the individual level. The expected benefit for the clients is reduced time and travel costs, since clients can complete transactions at agents' local business establishments within close proximity of their micro-businesses or homes. Clients will also benefit from extended hours of services, which give them greater flexibility around the hours when they bank. The independent agents should benefit from increased foot traffic and related sales at their places of business and increased revenue from transaction fees. Early business model analysis by the MFT indicated that the transaction costs

of this MFI will be dramatically reduced if the solution proves viable. The same analysis also showed that this model is the least costly means of servicing rural clients.

Pilot Process

The MFT began the RTS pilot in Uganda in January 2004. The MFT, a local technology partner, three partner microfinance institutions, their agents, and their microfinance clients are participating in the pilot. The RTS pilot team led the on-the-ground operations for the pilot program. It consisted of an on-site program manager, customer support liaisons, administrative staff and technical support staff. The pilot was overseen by the MFT. The pilot was originally scheduled to end in December 2004 having reached 4,500 clients. However, due to some unforeseen challenges described in this paper, the pilot was extended by three months and is scheduled to conclude on March 31, 2005. The pilot team has informed us that 1,500 clients will have been impacted by the end of the pilot. In addition, the team is setting up the support structures to ensure that those MFIs interested in continuing with the RTS solution will be able to do so beyond March 31.

The MFT's objective for the pilot was to develop an appropriate technology solution that could be used by all MFIs based on initial research on their MFI partner's operations, implement the solution in the field, and evaluate its effectiveness, appropriateness and usefulness. Based on their findings in the field, the team will then work with the MFIs to

integrate the RTS solution into their operations by optimizing both the technology and MFI business processes.

The authors were in Uganda from August 16 to September 3, 2004 to collect primary data as part of a third-party evaluation of the RTS. When these dates were chosen, it was assumed that the solution would have been in the hands of clients for a minimum of three months. Due to the challenges faced by the pilot team, the evaluation period coincided with the initial introduction of the alpha version of the RTS solution to clients; this provided us with the opportunity to gain firsthand lessons on the complexities in developing a new technology solution and implementing it in a developing country context.

STUDY DESIGN

The qualitative study that we performed closely matched the RTS deployment schedule because we sought to impose minimal disruptions when performing our field research. Towards this end, we were greatly facilitated by the pilot team's assistance and support.

Upon our arrival in Uganda, work was underway to implement the RTS in each of the partner institutions. The RTS team was in the first stage of training the staff and clients of participating MFIs. At one MFI, almost all staff members had received an overview of the RTS but had not been trained to use the point-of-sales devices. At the second MFI, field officers and tellers had received an overview of the RTS. At the third, at least two staff members and six client groups had gone a step further and practiced using the

devices to perform transactions. In addition, two of the six client groups at this third MFI had begun to record transactions using the point-of-sales devices during two previous group meetings.

DATA COLLECTION METHODS[4]

Our fieldwork relied on qualitative methods, which are mostly qualitative interviews (Weiss 1995) with samples of representative microfinance clients and other key stakeholders, complemented with field observations of microfinance settings that the RTS was expected to impact. Interviews and observations were conducted at various levels within each MFI, at training sessions, and with pilot team members.

MFI Executives

To gain a high-level understanding of how the three participating MFIs viewed the RTS, we interviewed the chief executive[5] of one MFI and held informal conversations with chief executives of the two other MFIs. These discussions centered on how the RTS could advance each MFI's business goals. We supplemented these discussions by sitting-in on a meeting between the MFT and an MFI's management team and three meetings involving staff members from the MFT and its pilot team. In addition, our understanding of the business context behind the RTS was facilitated through discussions with an MBA student intern who had been hired as a consultant to the pilot team.

[4] English is Uganda's business language, and all interviews took place in English unless otherwise stated.

MFI Staff

To understand how the RTS impacted the work of MFI staff members, we interviewed 11 of them from all three MFIs. Respondents were selected across departmental boundaries and included field officers and central office staff. Each interview aimed to provide insights into their work practices and the extent to which their everyday tasks had been affected by the RTS deployment. Each interview lasted about an hour and took place at the respondent's workplace.

MFI Clients

To understand how the RTS influenced the dynamics of clients' transactions with MFIs during group meetings, we observed two client group meetings in which the RTS was used. Both meetings involved clients from the same MFI, when they were using the RTS for their third time. In addition, while the meetings were in progress, we conducted qualitative interviews with 5 borrowers from each group. Each interview lasted about 30 minutes, and respondents were selected by their group's field officer to ensure variations in education levels, comfort levels with technology and length of membership in the group. The interviews covered the clients' demographics, the technologies that they currently use, and how they perceived the RTS.

To provide a basis for comparison, we observed a third group meeting, this time involving clients from a different MFI which had not started to use the RTS. Since this group attached a high priority to concluding its meetings promptly, it was not possible to

[5] The chief decision makers of the participating MFIs held different official titles. To preserve our

interview clients on an individual basis. Instead, we conducted a focus group interview with 17 clients who had arrived before the meeting started. The group interview covered similar questions as the above individual interviews, and lasted about 45 minutes. Interviews with clients from the above three groups were held mostly in their native languages and a little English, with a translator's assistance.

We also observed how microfinance transactions took place at a rural loans collection center. Representatives from client groups would show up at centers such as this one after their group meetings to make loan repayments on their groups' behalf. Although the RTS was not deployed at this center, we nonetheless studied this setting because the MFI that owned this center was planning to set up sub-branches modeled after this center (but in more rural regions, and with smaller floor areas) and to equip them with the RTS. In total, we observed representatives from 5 client groups interacting with the center's teller. When no clients were present, we interviewed the teller about her work. Our goals were to better understand the information and steps that were crucial for clients to complete their transactions successfully.

Training Sessions

To understand how end-users may encounter usability problems with the point-of-sales device due to possible gaps in their knowledge of the RTS, we observed how the pilot team conducted training sessions on the RTS for the clients and staff of one MFI. About 16 staff members attended the staff training session, which was conducted in

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respondents' anonymity, we standardize by using the "chief executive" designation. For the same reason, we standardize on the designations of all MFI staff members.

English and lasted about 2 hours. Since MFI staff members could read English, we carried out a self-administered survey at the end of the session to gauge the training's effectiveness. In total, 12 staff members turned in their responses (approx. 75% response rate).

Eighty-five borrowers attended the client training sessions. Half of these sessions and the ensuing break-out groups took place in English, while the other half was conducted in the most prevalent native language, Luganda. Each client's training lasted about 1½ hours in total. We observed 5 break-out groups comprising a total of about 25 clients. The proceedings of these 5 groups took place in English.

Technical Support

Finally, to understand the challenges in providing technical support for the RTS, we conducted qualitative interviews with 4 staff members from the ASP, on top of staff members who worked as information technology professionals in the participating MFIs. Each interview took place at the respondent's workplace, lasted about an hour, and covered his responsibilities and the obstacles encountered in carrying out these duties.

LIMITATIONS

The observations and interviews reported in this paper were limited to a 3-week period in August and September 2004, when the RTS deployment was in its initial stages. As mentioned previously, the pilot is expected to wind down in March 2005. When this paper was written during the intervening period, we were told that the project continued

to evolve and that ground conditions have changed. Where it added to the context of our paper, we incorporated updates from the RTS team about advancements that have been made since we left Uganda in September.

PRINCIPAL FINDINGS

In this section, we discuss our observations from the RTS training sessions, the challenges in integrating the RTS with participating MFIs' processes and systems, and early usage of the RTS solution by clients.

Stakeholders

Based on our interviews, we identified the following stakeholders in the RTS pilot. These stakeholders are in addition to the MFT, its pilot team in Uganda, and the RTS software developers who were based in India and the United States:

- **MFI management** teams who are responsible for the strategic directions of their respective MFIs. In total, three MFIs in Uganda participated in the RTS pilot.
- **MFI back-office staff members** who are responsible for the everyday operations of the MFIs' head offices as well as their branch offices. These staff members include branch office managers, customer service support officers, finance managers and their accountants, information technology managers and their technical staff, internal auditors, marketing officers, operations managers, product development managers, and in-house researchers. The staff member who is the most active liaison in his MFI for the RTS pilot was given the role of "RTS Manager," which was funded by the RTS team.

- **MFI front-line officers** who interact regularly with clients. These staff members include branch tellers who facilitate clients in performing microfinance transactions at the MFIs' branch offices and rural loans collection centers, field officers who supervise clients' weekly or fortnightly group meetings, and training officers who educate clients on topics like cash-flow management during group meetings. The typical front-line and back-office staff member possesses a tertiary education. In the field officer and remote branch office models, field officers and tellers respectively operate the point-of-sales devices and act as internal **agents** with whom borrowers transact. In the third-party agent model, more established clients act as **third-party external agents** regulated by the given MFI.
- **Clients** who take out loans from MFIs. Depending on their MFI's business model, clients are either individual borrowers, or take out loans collectively as a group of up to 50 members. Loans are disbursed at the start of the lending cycle, which is typically four months long. Clients make weekly or fortnightly repayments throughout the lending cycle, either at MFIs' branch offices, collection centers or group meetings. The clients whom we interviewed have limited formal education and English literacy, and their ages range between 32 and 62. Clients use their loans for their micro-enterprises, as well as their children's education and medical expenses. Two of the MFIs served male and female clients; the last permitted only women borrowers.
- **Third-party vendors** who implemented the MISs that participating MFIs use to maintain records of their clients' microfinance transactions and account balances. Through these records, the MIS enables an MFI to generate balance sheets,

operating statements and other financial reports. Each MFI had purchased an MIS application license from a separate vendor, and therefore employs an MIS which differs from other participating MFIs.

- **Application service provider** contracted by the RTS team to host server machines for the participating MFIs and maintain the necessary networking equipment to support wireless telecommunication between these backend servers and point-of-sales devices in the field, as well as provide local application support and troubleshooting skills.

Learning How to Use the Remote Transaction System

The RTS team tells us that a single training session, or even a few sessions, are not enough to train clients and agents in the use of a new technology, even when that technology appears to be relatively simple. The RTS team believes that training has to be an iterative and ongoing process.[6]

Client Training

We observed the pilot team conduct training sessions on the RTS for the clients and staff of one MFI. Each client training session was restricted to 20 clients. It commenced with a facilitator from the pilot team highlighting how the RTS benefits clients, followed by an overview of the technology and the essential steps for using it. Clients were next divided into small break-out groups of up to 7 members each and

[6] Since our departure from Uganda, the RTS team has assigned a full time staff member from the pilot team to each partner MFI to work with clients, agents, and MFI staff throughout the pilot. The pilot team members will train the stakeholders on the solution, involve them in the process, and gradually hand training responsibilities from the RTS team to the MFIs at the conclusion of the pilot[0].

every group was provided with a point-of-sales device. Every client was asked to perform a loan repayment and a savings deposit transaction on the device before she was allowed to pass it on to the next person in the break-out group. Each session ended with clients from all break-out groups reconvening to discuss outstanding issues with the facilitator.

The first experience of learning how to use the RTS appeared to be an intimidating experience for some clients. We observed that many of them took notes during their training session. Many of them also struggled with the point-of-sales device and a few of them almost gave up. But with other break-out group members prompting and cheering them on, every client eventually succeeded in using the device to complete the above learning transactions for herself. It appeared that encouragement from fellow clients helped to create a supportive learning environment within each break-out group. The clients' faces lit with a sense of accomplishment and they remarked with pride and self-confidence that the device was easier to use than originally expected. Small-group experiential learning with a focus on helping clients to gain practical experience with relevant tasks and transactions thus seemed to have an empowering effect on clients.

Clients at the training appeared to understand the facilitator's explanation of the RTS's benefits, in terms of more convenient access to agents. Several of them asked how soon the RTS could be deployed for them to use. In addition, at least one of them suggested that the MFT promote the RTS to other MFIs. These comments came from clients who are part of the third-party agent model and were excited about the RTS

because it enabled microfinance services to be offered at the agents' premises, which were considerably closer to their homes and workplaces. Without the RTS, clients had to visit the MFI's nearest branch office, which took as long as four hours round-trip via public transport. It was clear that these clients could see definite personal benefits from the RTS solution.

In contrast, after the first trainings of clients in the field officer model, many clients understood that the printed receipt is significantly harder to alter than a handwritten receipt, yet they could not clearly articulate other benefits associated with the RTS. In these early stages of the field officer model, it was harder to demonstrate compelling benefits to clients. As two staff members from the MFI which adopted this model conceded, it remained a challenge to determine how the RTS could benefit their clients in significant ways.[7]

Client Participation

Clients participated actively during the question-and-answer phase of their training sessions. For example, they pointed out that it was possible to forget one's PIN, that network problems or power failures could occur, and that the technology could break down in other ways. They also asked if transactions saved on a point-of-sales device would persist when the device was dropped onto the ground. From the above feedback, it appeared that clients were attempting to identify how the RTS could fail.

[7] According to the RTS team, in the field officer and remote branch models most of the benefits of the RTS accrue to the MFI. How much clients will benefit from the RTS will depend on how much the MFI chooses to change its business practices to concentrate on customer value.

On top of asking technical questions about the RTS, clients queried the policies that their MFI intended to adopt for the RTS. For instance, clients asked if they could make a larger loan repayment in one month and a smaller repayment in the next. Clients also inquired about the hours that third-party agents would be open to facilitate microfinance transactions. Similarly, they wanted to know if they could make loan repayments on the device should they lose or forget to bring their smartcards. These questions suggested that clients could see how the RTS would potentially impact the ways in which they access microfinance services.

MFI Staff Training

The RTS training session for MFI staff members adopted a similar format involving small break-out groups, but with a deeper coverage of the technical details. The training covered how the point-of-sales device captures transactions in the field and transmits this information to RTS servers, and ultimately to MIS servers at the MFI's head office through the infrastructure maintained by the ASP. The training also covered the distinction between online and offline transactions, together with their relative advantages and disadvantages.

Staff members appeared to understand the various options on the point-of-sales device's user interface. For example, all 12 attendees who filled out the questionnaire at the end of the staff training session correctly identified the "reverse transaction" menu item as the action to cancel a transaction that was incorrectly entered on the device.

Staff Participation

More importantly, staff members contributed critical feedback during the session. For instance, many of them pointed out that their MFI's MIS lacked a feature to check for and enforce minimum balances whenever clients perform savings withdrawals. But the alpha version of the RTS was designed to support minimum balances by making use of the MIS's implementation of this feature.[8] Such a dependence on the MIS systems was not scalable. We have learned from the RTS team that they have redesigned the solution and minimum balances will now be handled by the point-of-sales devices and the RTS server, thus removing the dependence on different MIS implementations.

During the feedback portion of the training, a few staff members expressed their concerns about offline transactions, because the business rules for computing loan interest rates and other variables were implemented on the MIS but not on the point-of-sales devices. They were concerned that when a client makes a loan repayment in offline mode, the point-of-sales device does not print a receipt that shows how the repayment amount is broken down into the principal payment and interest payment, nor does it reflect the outstanding balance in the client's loan account. It seemed that MFI staff possessed sufficient technical background to want to see some additional features in the RTS.

[8] For "basic" features that should have been implemented on an MIS, the RTS was originally designed to provide the same functionalities by "reusing" the MIS's implementation, as opposed to "reinventing the wheel" by re-implementing the same features on the point-of-sales device or RTS server. This principle of "reuse" is viewed as a best practice in software design.

Key Lessons from the Training Sessions

At the conclusion of the first training sessions, many of the clients and staff did not appear to have a complete understanding of how the RTS worked. When interviewed, not every MFI staff member could explain the distinction between online and offline transactions, nor could they explain their relative advantages and disadvantages, even though these concepts were covered during their training. Similarly, some of the clients and staff thought that transactions performed on the point-of-sales device are always updated on the MIS in real-time. They had either forgotten about, or were unaware of, offline transactions. As one client confessed, she did not feel that she had mastered the technology and asked when there would be more training sessions.

The concept of a PIN was also new to several clients and they did not fully grasp the importance of keeping this number private. When we interviewed them, one of them told us her PIN to demonstrate that she remembered it. We also learned that two of them kept their smartcards with printouts of their PINs. It takes time and patience for a group of people unfamiliar with the PIN concept to understand its security implications. We understand from the MFT and other industry informants that there have been similar precedents when PINs were introduced in other contexts. The RTS team and the MFIs will need to repeat this message to clients and staff over and over again throughout the pilot and beyond.

Some clients also did not fully grasp the potential risks of the new system. When asked if anything adverse could result from the RTS, a client answered, “What bad things

could happen?" We did not know, for example, if this client had been asked or remembered that she should keep her RTS-printed receipts for at least a month after the transactions had taken place, in the event that transactions recorded on the point-of-sales device were lost or inadvertently modified should the RTS breaks down. But this point had been covered in the training sessions that we observed.

As may be expected with users who have not handled this type of technology before, many of the clients and agents who understood the RTS at the conceptual level were not necessarily adept in using it after the first training sessions. At one group meeting, we observed the field officer taking more time than anticipated to perform transactions using the RTS, even though he had been trained to use the point-of-sales device a month ago and was using it for the third time. To expedite the meeting, a member of the pilot team took over from the field officer.[9] The field officer's lack of familiarity was noted by a client whom we interviewed. She questioned whether field officers knew how to use the device or were experienced with it. It therefore appeared that at least one front-line officer required more training and practice with the device than he had received.

On the other hand, clients identified two limitations with smartcards. First, clients were concerned about what would happen if they lose their smartcards or forget to take them

[9] This seems to indicate that field officers and clients will require continued, on-going training and support from the RTS team. As indicated earlier, the RTS team is assigning a pilot team member to each MFI throughout the pilot for exactly this purpose.

to a meeting.[10] This is an issue for clients in the third-party agent model, and the relevant MFI had anticipated and devised policies to handle these situations. In the other models, clients are still able to transact with the field officer or sub-branch teller, although through manual means.

Second, based on our interviews, as well as observations of the rural loans collection center and borrowing group meetings, it is common for clients to send proxies to MFI branch offices, collection centers and group meetings to perform loan repayments and other transactions on the former's behalf.[11] With smartcards, however, clients will need to share their smartcards and PINs with their proxies.[12] These limitations were not covered by the training facilitators in the first sessions that we observed, but clients nonetheless inferred and highlighted them during the question-and-answer phase of their training session.[13] This shows that both clients and staff paid attention to the training, were interested, and wanted to understand how the RTS solution would impact

[10] The RTS team is recommending to their MFI partners that clients who forget their smartcards be charged a small fee to help them remember.

[11] Some MFI staff members whom we interviewed frowned on this practice of sending proxies and maintained that it is important for clients to attend group meetings. In fact, a staff stated that the need for clients to share their PINs with proxies will "encourage" more clients to turn up for meetings. Nonetheless, based on our interviews with clients, there were instances when they found it necessary to send proxies. For example, clients were sick or had an emergency situation.

[12] From our interviews, clients preferred to send trusted relatives as proxies. But in some situations, only fellow clients were available as proxies. In any case, proxy payments introduce a security vulnerability only when the RTS is configured to track individual borrowers. In the group lending models, since clients know each other the security risks related to personal identification are relatively low or non-existent. Since this is the case, the RTS could be redesigned to permit all group transactions to be performed without PINs. We learned that the RTS team has added this as an optional feature in a future version of the solution.

[13] Training and product development were structured as iterative processes. The RTS team tells us that as the clients and staff learn more about the RTS, they should become more comfortable with it. By the same token, as the RTS team learns more about the intricacies of their MFI partners operations, they are able to more finely tune the solution to meet their needs.

them.

Institutionalizing the Remote Transaction System

Based on interviews with the management and staff of the participating MFIs, the RTS seemed to be an initiative which received very strong support from all levels of the hierarchy in these organizations. Nevertheless, integrating the solution into the MFIs, their agents, and clients was not a smooth process.

Back-end Challenges

Before we arrived, the RTS team had a number of problems getting the technology to work in Uganda. This delayed their implementation by several months. When we arrived, there were still on-going problems with the technology and its installation. Delays in the pilot during the time we were in Uganda were primarily due to the technical difficulties in integrating the RTS with the MFI's existing MISs.

Sometimes there were inconsistencies between the way the RTS was designed and the way in which one of the MIS systems worked. One such example was related to the minimum balance issue described earlier. Since one MIS could not handle minimum balances, the RTS team decided to build that capability into their own solution. Given the costs of postponing the pilot further to resolve this issue, the RTS team and the affected MFI decided to proceed with the RTS deployment anyway. They took precautions against the risk of clients over-withdrawing from their accounts by disabling

savings withdrawals on the point-of-sales devices until the minimum balance feature was built into the RTS.[14]

In other cases, the RTS and MISs worked well together, but the way in which the MIS was used by the MFI staff differed from the best practices recommended by the MIS vendors. The integration of the RTS with the MISs became more complex in these circumstances. For example, even though one MFI adhered to the "declining interest" principle[15] and its MIS had a feature to compute declining interest rates, this feature was not in use. Instead, the MFI's accountants had devised a separate method to perform the same calculations. The RTS team had worked with the MIS vendors to develop the specifications for communication between the RTS server and the MIS servers. So the RTS was designed to compute loan repayment interest rates by making use of this feature. That is, MFIs who adopt declining interest rates were expected to use this feature in computing interest rates, and this assumption carried over into the RTS's design. For the RTS to work correctly with the given MIS, this feature first had to be appropriately configured and used by the MFI.[16] The RTS team told us that this was a real lesson for them. They had expected the MFIs to adhere to best practices with their

[14] This problem with minimum balances was not an issue for the other MFIs.

[15] With declining interests, interest payments for remaining weeks in the loan cycle were dependent on the outstanding loan balance. As such, a borrower has an incentive to repay more of her loan balance earlier in the loan cycle.

[16] The RTS team had a choice. One option is that the product can be designed to compute interest rates by making use of the accountants' "workaround" method. This approach entails designing a different version of the RTS for each participating MFI. Or the RTS team can develop a more generic solution and work with the MFIs to change their business practices. Both have challenges. However, to develop a product that will achieve scale, some standardization is required. Customization limits standardization and increases development, maintenance and support costs. Despite all these tradeoffs associated with customization, we believe that it is necessary to some extent. In fact, we have learned that the RTS team is now developing two versions of the software for exactly this reason.

MIS software and were quite surprised to find that this was often not the case. In product development, it means the difference between a specification being correct and the product not working for the client.

Similarly, at one MFI, accountants had batched transactions according to the client's account number and transaction date. Transactions performed on any given day were posted to the MFI's general ledger only at the end of that day. Due to an undocumented feature in the MIS, however, the RTS/MIS solution allowed agent transactions to be posted to the MIS as soon as they occurred. This was inconsistent with the MFI's accounting practices, and, according to the RTS team, the MFI did not want to use the RTS solution as long as it sent agent transactions to the back-end in this manner. To make matters worse, the agent transactions were missing from financial reports generated by the MIS. It was frustrating to the RTS team and the MFI to only discover these issues when the RTS was ready to be deployed. The relevant stakeholders continued to work on these problems after we left Uganda.[17]

Getting the Details Right

When a technology solution is designed and developed, it is critical to get the details right. As part of the accounting practices which one MFI's borrowing groups had adopted, each client was required to pay a "group maintenance" fee at every meeting.

[17] We learned that the RTS team subsequently altered the connector for this one MFI, so as to enable the MFI to retain its original posting practices. Specifically, the agent transactions were held on the RTS server and never passed to the MIS. Thus the technology was changed to meet a specific MFI need, that is, a unique version of the RTS product was created for this MFI.

This fee was not supported by the RTS as a transaction, because the RTS team was unaware about this fee when the RTS was designed. With the RTS unable to track the payment of this fee, RTS-printed receipts could not acknowledge that clients had paid the fee. Clients subsequently questioned the fee's omission from their receipts when they used the RTS for their first time.[18]

The RTS team told us that even though they had done extensive work with the MFIs to understand their business processes before developing the original RTS specifications, the team was not informed by the MFI staff about this fee because the MFI does not even track it. It is only tracked at the client and group levels. It was only when the device was in the field, with the RTS pilot team members working hand-in-hand with the group leaders, that this fee was discovered.

Business Process Changes

One of the MFIs did not permit its field officers to handle cash at group meetings. Hence, this MFI's clients transact cash with the MFI through an intermediary commercial bank. Every group maintained group savings accounts with a bank under the MFI's supervision. After each group meeting, the group leaders would travel to the bank to deposit the funds that were collected during the meeting.

Because of the way the banks operate, a bottleneck is created between the bank and

[18] We learned from the RTS team that they subsequently worked with the MFI and helped them adopt a new business practice. The improved process provided the clients with greater visibility to the payment, accumulation and use of this fee by the group.

the MFIs accounting practices because the bank only supplies the MFI with deposit information once a month. Even though the bank issues a deposit confirmation slip to the group leaders after depositing their money, it could take as long as two weeks before that slip is given to the MFI. In the meantime, without the slip, the MFI's accountants cannot confirm the exact cash amount that has been deposited with the bank, and hence could not update their records.[19] Worse, the slip was prone to being misplaced and clients had lost it on several occasions. Field officers found it burdensome to visit the bank to obtain a replacement slip, but did so because it was holding up the MFI from updating its accounts. One of them recounted: "When the deposit slip is lost, I as the field officer will make the client feel the pain. Because I get frustrated when one small part in the process messes up the entire process."

The MFI's field officers believed that the RTS could alleviate this bottleneck. After all, the RTS was designed to transmit details of transactions from the field to the MFI's back-office as soon as clients perform these transactions using a point-of-sales. The RTS, as an electronic means of data transmission, was expected to be more efficient than waiting for clients or the bank to deliver the deposit slips and statements to the MFI.

But the point-of-sale device's ability to transfer information from the field and the need to force clients and banks to provide the MFI with accurate deposit information on a more

[19] Even with the deposit slip, however, deposits cannot be officially confirmed until the MFI receives its bank statements, which takes place once a month. As a result, reconciliation at this MFI can only occur once a month.

timely basis are two separate issues. While the RTS facilitated the former, it could not address the latter. As a back-office staff member feared, either bank practices need to be improved or the RTS had to hold transactions at the RTS server level until the end of the month when the MFI accountants had the bank statements and were ready to reconcile. This is another example of matching technology innovation with business innovation. We have been told that the RTS team is now seeking to help this MFI redesign its business practices so that it can move from an end-of-month reconciliation process to a process that occurs much more frequently. In this way, the MFI in question will be able to take greater advantage of the RTS solutions' capability.

Key Lessons from Institutionalizing the Remote Transaction System

It is not clear to us whether sufficient front-end consultation with MFI staff took place. On one hand, a staff member at one MFI revealed that his organization had provided the pilot team and RTS programmers with relevant details about its operations and systems, including how its accountants were using the MIS. The consultation spanned at least four months immediately prior to the RTS rollout, and he rated the overall level of consultation as "pretty good." In fact, he felt that these discussions took longer than required. On the other hand, a staff member with another MFI believed that his organization should have been consulted more. He seemed confident that he and his co-workers could have helped to identify some of the above difficulties in systems integration.

The above incidences highlight the importance of understanding the business practices

of the MFIs at a detailed level. It is equally important to understand the technical capabilities and limitations of the MIS systems that MFIs employ. And finally, it is critical to understand how these practices and systems interact.

Although technical details should be available from the MIS' technical specifications and working with the MIS vendors, which is the approach the RTS team took, such an approach is not always sufficient. The batch numbers and declining interest rates incidents showed that is also critical to observe how the solution works within the participating MFI, since the MIS systems were not always used according to the best practices that the MIS vendors had prescribed. Furthermore, the group maintenance fee incident demonstrates that when devising requirement specifications, systems designers should not assume that MFI staff could provide them with all the necessary details. Instead, technology innovators should also send their own staff to observe and participate in ground-level practices at the client and group levels over an adequate period of time.

Hence, it is critical to understand how an MIS is used in the context of a particular MFI's business and accounting processes. Similarly, it is critical to understand how an MFI's processes actually occur in the field. This requires that MFI staff, agents, and clients participate actively in the design process and provide feedback to the systems designer at all stages of the design and implementation.

In retrospect, the RTS team agrees that they should have put their team members into

each of the participating MFIs much earlier. They also would have had a design team on-the-ground in the first few months of the pilot. However, they feel that even with these precautions, they would not have discovered all the nuances of the participating institutions. They believe it is when the point-of-sale device and the RTS solution are in the hands of the MFIs and their clients that most of the institutions' unique practices and the implications of these practices for technology design could be uncovered.

More importantly, even though consultation with the MIS vendors and the MFI staff can help to anticipate some of the integration pitfalls, this is only the first step. According to the RTS team, getting the attention of the MFI and MIS staff on a timely basis was also challenging for the RTS developers. Even though each of the MIS vendors were paid and had a contract with the RTS team to deliver services by certain deadlines, they did not always meet those commitments. The RTS development team reported that one vendor, in particular, was notorious for non-delivery. The vendor's resistance to standing by its commitments led to several months of delay for one of the MFIs.

Using the Remote Transaction System

Imposing the RTS directly onto the field officer model not only failed to achieve compelling benefits for clients, but it led to longer meetings. It actually made the group process more complex. In the two group meetings where the RTS was used, we observed that each meeting was extended by about 1½ hours. There were three reasons. First, the user interface required excessive steps to perform a loan repayment or savings deposit transaction. Second, the RTS solution was originally used in parallel

to the pre-pilot manual record-keeping processes, which made the former an additional step in the group meetings.

Third, with the RTS solution originally designed to support online transactions, each client transacting on the point-of-sale device involved a real-time call to the back-end systems.[20] Coupled with the novelty of the system to clients, it took each of them an average of 2½ minutes to perform transactions on the device. The addition of the point-of-sale device could extend a meeting with 24 clients present by an extra hour. Since the RTS team had tried to build a "standardized" product that could meet the needs of all three MFIs, the solution was not optimized for the field officer model, and by using the device to capture individual clients' transactions, an additional stage of electronic record-keeping was introduced into group meetings.

Key Lessons from Using the Remote Transaction System

There is a tension between technology innovation and business process re-engineering. This tension is also evident from the above observations on the "group maintenance" fee and different interest rates across MFIs. As such, during each iteration, one can either adapt the technology to suit the existing business practices or adapt these practices to suit the technology. Both options incur their respective costs.

As we have described for the field officer model, implementing the RTS solution over

[20] As described in a previous sub-section, one important purpose of the back-end call is to compute interest rates, since every MFI calculates them differently. In some cases, there are different calculations within one MFI for different types of clients.

existing business practices added time and cost to the MFI, their agents and their clients. The RTS team has concluded that it is more likely that MFIs will see significant benefit from the RTS is if they restructure some of their business processes to be more compatible with some features in the RTS solution.

To overcome the above obstacles, the RTS team informed us that they had modified the software for the point-of-sales device to minimize the number of steps required, shifted to an exclusively offline model for group meetings, and began working with the MFI to re-engineer their group meetings to maximize the advantages of the RTS.[21] In the process, the RTS team concluded that it needs one version of their software for the group models and another version for the third-party agent model; the RTS team found that the variations in the models were too extreme to be effectively supported by a single solution. There is a tradeoff between developing a solution that can have wide application versus one that can meet all the needs of a specific MFI. Given the need to achieve scale, the fact that the RTS team had to develop different versions of the RTS suggests that technologies for the development context need to be designed such that they can be flexibly adapted for localized needs.

KEY RECOMMENDATIONS

The Remote Transaction System represents a convergence of technical expertise, business experience and sponsorship that is not always witnessed in microfinance

[21] According to the RTS team, these changes have significantly reduced the meeting time. If the MFI chooses to adapt the new group methods, the RTS team believes that there will be increased transparency for the clients together with greater efficiencies for both clients and field officers.

initiatives. Yet, despite these resources, the complexities in developing a new solution, trying to modify it to fit three different business models, and piloting the system in a challenging environment resulted in a number of obstacles and challenges. These difficulties, and other (less serious) ones that we did not describe, repeatedly delayed the successful deployment of the solution. Even though the authors were responsible for conducting a third-party evaluation of the end-users' experiences with the system during summer 2004, the pilot was already three months behind when we arrived, and it was just being rolled out to microfinance clients and staff members.

Attempts by other developers to create new technologies specifically for underserved communities and deploy them under these conditions will most likely encounter similar pitfalls. To benefit from the above lessons in rolling out the RTS, project implementers should consider the following recommendations when working with local organizations, such as microfinance institutions.

Management Must Be Open To Change

It is critical for anyone considering the integration of new technology to embrace the fact that rolling out a new technology is in itself an attempt to change and advance the state-of-the-art within an MFI. The RTS pilot is no different. We have shown that bringing in the new RTS technology is a learning experience for everyone involved – from the systems designers, the developers, the implementation teams, as well as the participating MFIs, their staff, agents, and clients. Lessons on how to better deliver training, systems integration, technology improvements, and business process change

were being learned throughout the pilot. Stakeholders therefore need to be flexible as they learn, and iterate the technology and the business processes continually to take advantage of the latest lessons.

The preliminary experience of the field officer model suggests that appending the RTS on the existing practice of group meetings did not yield significant benefits to the clients. Rather the RTS extended each group meeting by about 2½ hours.

In the remote branch office model, group representatives were already visiting the sub-branch to make their deposits. The only change that the RTS introduced was that financial transactions would no longer be captured on paper. Rather they would be captured by the point-of-sales device. This adds some, but limited, value to the MFI and its clients. The RTS could bring even greater business value to the organization if the MFI changes some of its withdrawal and reconciliation practices, so as to enable a more efficient means of accessing group funds and providing regular reports to their clients. These changes will also give clients more transparency into their accounts.

On the other hand, clients in the third-party agent model were enthusiastic about the RTS because they immediately saw how the technology could substantially reduce their traveling time and costs to access microfinance services, so as to make it more convenient for them to access microfinance services.

The above examples suggest that the full promise of technology cannot always be harnessed without re-engineering existing business processes. Given the learning possibilities and business opportunities that a pilot offers, MFIs should recognize the opportunities for change that technology offers and seize them. We understand that MFIs may not necessarily want to adopt every recommended change, however. The lesson is that technology innovators must work with local organizations to design and introduce technology that is consistent with the latter's capacity for change. We believe that the right balance can be found.

Technology Innovation and Business Innovation Go Hand-In-Hand

Since this paper is intended for a conference whose central theme is "poverty alleviation through technology," it is even more timely to underscore that technology is only one means of realizing gains in operational efficiency and other payoffs. A new technology is unlikely to reap the desired benefits without the necessary systems and processes in place that could facilitate it. In other words, technology is only an enabler.

In some cases, benefits can be realized by gaining a more comprehensive understanding of existing processes and improving them in ways that do not require sophisticated technology. For instance, even though the RTS enables transactions to be communicated electronically from the field to the MFI's back-office, which is faster than waiting for clients to hand over bank deposit slips, the relevant MFI could potentially implement alternative and simpler solutions that do not require technology.

More importantly, unless shortcomings in existing processes are first resolved and new business models are engineered to take advantage of the technology, the new technology may very well complicate the situation, instead of achieving its intended benefits.

The reader may recall, from the bank deposit slip example, how the RTS could provide more frequent client data than the MFI was able to manage from an accounting perspective, based on the MFI's current reconciliation procedures and the limitations imposed on it by banks. To pave the way for the RTS, it appears that a more effective means of confirming clients' cash deposits with banks that is more efficient and less prone to delays is required. Only then can the RTS' capability to provide daily transaction information be fully utilized. Otherwise, the MFI must still wait until the end of the month to perform their reconciliation, and a key benefit that the RTS can provide would not be realized.[22]

Engage With Stakeholders Early and Often, On the Ground

By consulting stakeholders as extensively as possible in the early stages of the design lifecycle, and then continually throughout the development, testing and implementation phases, the deployment will no doubt proceed more smoothly. However, technology innovators should expect challenges to arise. Timelines and budgets should therefore be developed with the expectation that problems and unexpected delays will occur.

[22] The RTS team reports that the MFI in question is willing and eager to work with change consultants to incorporate new practices into its business. The RTS team also tells us that some of the recommended business improvements to the field officer model can increase the efficiency of group meetings even without the RTS point-of-sales device in the field.

For example, one MFI's staff knew that their MIS lacked a minimum balance feature and pointed that out during their training. Similarly, the RTS was designed without any awareness of the group maintenance fee that clients paid. There was also no knowledge initially about the transaction batch numbers assigned by accountants. If these issues could be discovered earlier, there would have been more time to iron out the above systems integration obstacles with MIS vendors.

We learned from the RTS team that they had spent weeks with their MFI partners to understand their business practices before building the initial RTS prototype, and continued to meet with the MFIs over several months in the early stages of the pilot. Unfortunately, the RTS team felt that these discussions were still insufficient because none of the above problems surfaced during these meetings. The RTS team now believes that the most effective approach is to have design and business re-engineering teams *on the ground* early in the process.

Some readers may argue that clients, who are poor and illiterate, are ill-equipped to participate in the technology design process. Our observations, however, led us to conclude that consulting with clients early in the process is essential. Earlier, we mentioned the sophistication of clients who inquired about RTS-related policies that MFIs needed to discuss, such as security vulnerabilities they would experience if their PINs were shared with proxies and how they would perform microfinance transactions if smartcards were lost. Clients were also the ones that noticed that group maintenance

fees were omitted from RTS-printed receipts.

Training Should Empower All End-Users and It Should be Continual

The RTS training sessions for clients in the third-party agent model demonstrate that by focusing on and clearly communicating the benefits of the piloted system, it is possible to market the technology to clients as a value-added service offered by the MFI and to generate strong customer interest in it.

Small group experiential learning provides each client with the opportunity to gain hands-on experience with the point-of-sales device and to succeed in performing microfinance transactions for themselves. This learning model is possible when there is adequate local staff from the pilot team to facilitate each break-out group and MFI staff at hand to render assistance during the training session. Small-group experiential learning appears to be effective in encouraging clients to persist in the face of initial difficulties with the technology, and in fostering clients' confidence in their ability to use the system. Hence, we recommend this training strategy for a technology pilot.

The MFT takes the position that every end-user should undergo multiple training sessions, such that subsequent sessions build on topics covered in previous ones. This view is supported by our observation that several MFI staff and clients did not fully comprehend the RTS, and that a field officer was not familiar with the point-of-sales device, despite all of them having attended one training session. Furthermore, some clients were not keeping their PINs secure or taking adequate backup measures against

the possibility of a RTS failure. We therefore recommend a series of training sessions that educate end-users on security and other precautions, on top of how to use the piloted technology.

On the other hand, it is important to remember that additional training comes at a cost to the institution. More observation and research is required to better understand and prioritize the amount of training and topics required to help end-users be more effective with the technology solution.

It is also important to ensure that the person conducting the training is credible and knowledgeable. As observed above, the field officer's lack of familiarity with the point-of-sales device was noticed by a client and may not inspire clients' confidence in the technology. This is especially true when the field officer is supposed to be the expert who will guide clients in using the RTS. Hence, the effective long-term strategy is to build capacity within MFIs for front-line staff members to train clients on the technology solution, so that clients will be positive that the staff members are proficient with the new system.

CONCLUSION

Microfinance has met with some successes in poverty alleviation but currently faces the dual challenges of rural outreach and operational efficiency. Technology solutions such as the Remote Transaction System promise to address both of these issues by making it more cost-efficient for microfinance institutions to offer microfinance services in rural

and peri-urban regions, so that savings, credit, insurance and other financial services could be readily accessed by more individuals who need them most.

Our goal in writing this paper was to draw instructive lessons from the implementation and rollout process for the Remote Transaction System with three microfinance institutions in Uganda. This deployment represented the convergence of technical expertise, business experience and sponsorship on an impressive level that is not always witnessed in microfinance initiatives. Yet, despite these resources, the challenges in piloting this system forced the RTS team and its partners to face and deal with a number of obstacles.[23]

In this paper, we describe the complexities in piloting the Remote Transaction System and generalize from these findings to recommend measures that other technology innovators and their partners could adopt when implementing new technology in the development context. We believe that many of these lessons are not only applicable to technology deployments in microfinance but also across many other domains. We hope that the lessons highlighted in this paper will provide the reader with positive directions to innovate and implement technology for underserved communities in both developing and developed countries.

[23] At the time of this writing, the RTS team informs us that they have overcome many of the obstacles described in this paper. While they continue to face new challenges every day, they are confident that they are making significant progress. The RTS solution has been implemented with more than 35 groups in the remote branch office model, 8 groups in the field officer model, and with 1 agent and 30 clients in the third-party agent model. The team continues to refine the solution, the rollout process, and the business processes, as well as learn from their partners.

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REFERENCES

Barr, Abigail, Marcel Fafchamps, and Trudy Owens. *Non-Governmental Organizations In Uganda: A report to the Government of Uganda*. Oxford, UK: Centre for the Study of African Economies, Oxford University. December 2003.

Grameen Bank, 2004. *Breaking the Vicious Cycle of Poverty Through Microcredit*. [accessed on January 1, 2005]. Available at: http://www.grameen-info.org/bank/bcycle.html

Weiss, Robert S. *Learning from Strangers: The Art and Method of Qualitative Interview Studies.* Free Press, New York, NY, USA. 1995.

Women's World Banking 1995. *The Missing Links: Financial Systems that Work for the Majority.* [accessed on January 1, 2005] Available at: http://www.womensworldbanking.org/English/PDF/report_policy%20change_missing%20links.pdf