Microsoft Research India

Case Study

Evaluating the viability of a mobile phone-based, SMS/GPRS-enabled, client data collection channel for urban microfinance[1]

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Summary

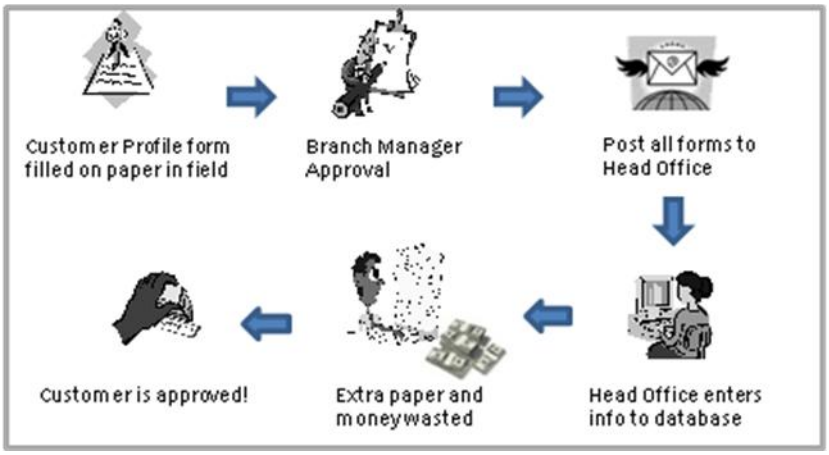
- Ujjivan, a young microfinance institution (MFI) in India serving urban low-income clients, has been aggressively scaling operations over the past year. This has meant that the efficiency of the organization's 'new client acquisition process' has become even more critical to the overall success of operations.
- Currently, there are concerns around the MFI's high costs of collecting and processing new client information, stemming from double data entry, error correction, data transport, stationery, and back-office staff. As a result, the question posed by Ujjivan staff was whether the introduction of a technology-based solution could improve Ujjivan's front-end customer profile creation and management process by reducing costs and increasing efficiency.
- In this paper, we use the average prices of individual inputs in the customer profile creation work process to assess the comparative value-addition from using one of two alternate mobile phone-based interventions (SMS-enabled and GPRS-enabled) to streamline Ujjivan's customer profile creation process.
- We find that the transaction cost savings per Customer Profile Form (CPF) from the technology intervention is ~Rs. 11 using the SMS-based system and Rs. 10 using the GPRS-based system, i.e. a significant 50% savings per form, in comparison to the existing paper-based data collection process.
- However, when the costs of the up-front fixed investments in devices and the ongoing costs of maintaining the technology-based channels are included, we find that over a 6 year time-frame, Ujjivan can only expect to recover around 44% of the channel investments in the SMS-based system and 10% of the investments in the GPRS-based system in present value terms.
- Our calculations show that while the implementation of both these systems will deliver profits in the form of cost savings, the profits generated through cost savings will not be sufficient to recover the heavy initial investments over a reasonable timeframe. The proposed mobile-phone based channels for this task are, therefore, not recommended for implementation from a financial viability standpoint under present conditions.
- We finally examine the sensitivity of our conclusions on technology-based front-end channel cost-effectiveness to changes in key input prices. The viability of technology channels can be expected to increase as device costs for a given set of functionalities fall, labour costs rise, labour productivity/ efficiency decreases (i.e. complexity of the task to be performed manually increases), and as the scale and scope of the device's use increases (conditional on data transfer costs).

I Background and task workflow

Ujjivan is a young microfinance institution (MFI) headquartered in the southern Indian city of Bangalore (operations commenced in 2004), providing microfinance services to urban low-income households (earning between Rs. 2000 and Rs. 7000 in household income per month). They operate as a Non-Banking Finance Company (NBFC), primarily providing loan products (along with some savings) to working women from these households. They also facilitate the purchase of life insurance policies for their members. Outreach (as of May 2007) stood at 24,100 clients in Bangalore, served through 13 branches, each of which employ 8 loan officers, a Branch Manager and an Accountant. The organization, however, is scaling rapidly in Bangalore and expanding to other Indian cities, and expects outreach to grow three-fold and revenues to grow four-fold over the next financial year. For this reason, the efficiency of their new customer acquisition process has become even more critical to the overall success of the organization's operations.

Currently, there are concerns around the costs of collecting and processing new client information. Each new customer requires a detailed Customer Profile Form (CPF) to her name during the initiation/ training period, which includes data on her household's characteristics, occupational affiliation, earnings, expenditures, outstanding financial obligations, housing, well-being measures, etc. Each of these paper forms is filled out by hand by the Ujjivan loan officer (referred to as the Customer Relations Staff - CRS) in the field (at or near the customer's house). All CPFs for new customers are then collected at each branch office and couriered to the Head Office (HO). At the HO, 2-3 back-office staff (Data Entry Officers - DEOs) are then employed to manually enter the data from the paper form into the back-end database on a PC. This workflow has resulted in high costs associated with double data entry, error correction, data transport, stationery (~5% of expenses in the first year of operations), and back-office staff (~15% of expenses in the first year of operations).

Figure 1: Existing manual CPF creation process

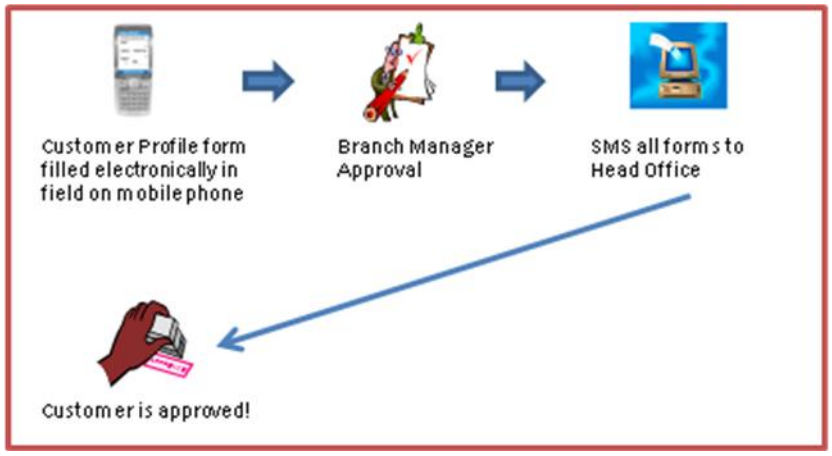


The logical question to ask was, therefore, could the introduction of technology-based solutions to enable Ujjivan's front-end data collection in the urban microfinance context, improve the customer profile creation and management process by reducing costs and increasing efficiency? Using a set of figures on the average current prices of individual inputs in the customer profile creation work process,

we assess the comparative value-addition from using alternate technology-based interventions in enabling Ujjivan's CPF creation process. The interventions we explored are briefly described below:

A) **SMS-based system** – In this intervention instead of a paper form being used to fill in client details in the field, the loan officer enters the data directly into an application loaded on a mobile (smart) phone (one for each CRS, Figure 2). Data is then transferred from the client location to the central database at the Head Office via SMS. The SMS messages are received by another smart phone that acts as an SMS server at the Head Office, which decodes the incoming text messages and updates the client database on the server automatically[i]. The role for the Data Entry Officer (DEO) at the back-end for this task is thereby eliminated.

Figure 2: SMS-based CPF creation process



B) **GPRS-based system** – In this system, the loan officer (CRS) directly accesses a web-based application that feeds into Ujjivan's central customer database using a GPRS-enabled smart phone and enters the client data directly into the web-based application from his/her field location (Figure 3). Here again, double data entry of the CPF is eliminated.

Figure 3: GPRS-based CPF creation process

II Financial viability assessment

Table 1 lists the various transaction costs incurred by Ujjivan in acquiring 1 new customer's profile data. It is clear that there are cost savings to be had from (1) the omission of labour costs in double data entry and (2) stationery costs of recording this information both on paper and in electronic form. Including the costs of transmitting data via SMS or GPRS from the field, the *transaction cost savings per CPF is ~Rs. 11 using the SMS-based system and Rs. 10 using the GPRS-based system, i.e. a significant 50% savings per form*.

Table 1: Ujjivan's transaction costs in acquiring 1 new customer's data[1]

Cost item (per Customer Profile Form – CPF)	Paper-based system	SMS-based system	GPRS-based system
Front-end data collection labour cost			
Average time spent by CRS in filling out 1 CPF (min)[2]	19	19[3]	19
No. of new CPFs processed per CRS, per month[4]	25	25	25
Monthly salary of CRS (Rs.)	4500	4500	4500
CRS' time cost in filling out 1 CPF (Rs.)	8.20	8.20	8.20
Back-end data entry labour cost			
Average time spent by DEO in entering data of 1 CPF (min)[5]	14	0	0
Monthly salary of DEO (Rs.)	4000	0	0
DEO's time cost in entering 1 CPF's data into the MIS	5.37	0	0
Paper CPF cost			
Stationery expenses, including pens, glue, pins, etc. per CRS, per month	35	0	0
Stationery expenses per CPF	1.4	0	0
Paper and printing cost, per CPF	1.25	0	0
Paper CPF cost (Rs.)	2.65	0	0
Data transport from field office to HO			
Courier cost per CPF	3	0	0
Per SMS cost[6]	0	0.01	0
No. of SMS messages per CPF[7]	0	5	0
SMS cost per CPF - variable rate (Rs.)	0	0.05	0

GPRS data transfer cost per CPF[8]	0	0	1
Total variable cost per CPF (Rs.)	**19.22**	**8.25**	**9.20**
SMS Savings per form (Rs.)	10.97		
GPRS Savings per form (Rs.)	10.02		

[1] All figures in this table were either estimated or approved by Ujjivan management.
[2] Each CRS is estimated to spend on average 19 minutes filling 1 CPF; average monthly salary for a CRS is Rs. 4500; 40 hour work week.
[3] Ease of using alternate data entry channels is assumed to be similar – in a preliminary usability test of the phone-based application, the CRS was able to complete 1 CPF's data collection using the phone in ~20 minutes (on his first interaction), comparable to the 19 minute average using the paper form. Part of the ease of the phone-based channel is due to its menu-driven navigation structure.
[4] Each CRS processes 25 CPFs on average each month, until they reach the limit of 500 customers per CRS.
[5] Each DEO is estimated to spend an average 14 minutes entering 1 CPF's data; average monthly salary for a DEO is Rs. 4000; 40 hour work week.
[6] SMS rate plan at 1paise per SMS for a fee of Rs. 49 per month. Details at http://www.hutch.in/prepaid/offers_kar.asp#sms@1p
[7] Data entered on each CPF is the equivalent of 750 bytes. With a single SMS being able to hold 160 bytes of information at most, the number of SMS messages needed per CPF is 5.
[8] GPRS cost based on rates of Re. 0.1/10 Kb of data (details at http://www.hutch.in/planethutch/PlanetHutch_charges.asp), with 10 Kb being the lowest single unit of bandwidth usage. Since accessing a web-based CPF in the GPRS system on the phone will involve both a download and an upload of the application, the data usage measure is estimated at 100 Kb per CPF (the application size is 32kb and the filled data is around 2kb; given the two-way application transmission, estimated total data transmitted is 32*2 + 2 =66kb . Another 25kb has been added in case the client's photo is also transmitted electronically).

While the recurring transaction cost savings might be high, clearly the technology-enabled channels require heavy fixed and ongoing investments in devices, software, and wireless data plans. Table 2 lists the investments that would be needed to enable phone-based field data entry of CPFs across all 13 branches of Ujjivan in Bangalore, each of which has 8 CRS (total of 104 CRS across all branches), each of whom recruits on average 25 new customers per month. The total fixed investments in the SMS-based system are marginally higher, due to the need for an additional smart phone to serve as the SMS gateway for the server database at HO. However, the cumulative operating costs of the GPRS system over a year of operations are higher, primarily due to the rental costs of having a GPRS data connection on each phone, in addition to the rental for the basic voice plan.

Table 2: Investments in mobile-phone based front-end channels

	SMS-based system – amount (Rs.)	**GPRS-based system – amount (Rs.)**
Fixed Investments		
Field data collection device (mobile phone with required features) per CRS	12,000	12,000
Back-end SMS processing device (mobile phone as SMS server)	12,000	0
Application development costs (mobile phone-based or	20,000	20,000

web-based)		
Total fixed investment for year 1 (104 CRS)[1]	**1,280,000**	**1,268,000**
Operating Expenses		
Training of the officers (Rs. 100 per CRS)	10400	10,400
Monthly rent for the mobile phone connection (Rs. 150/ month, per phone)	189,000	187,200
Yearly rent for GPRS connection (Rs. 600 per phone per year)	0	62,400
Stationery (pens, staples, etc. – Rs. 10 per CRS)	1,040	1,040
Repair maintenance (Rs. 250 per phone per year)	26,250	26,000
Total operating expenses for year 1 (104 CRS)[1]	**226,690**	**287,040**

[1] 13 Ujjivan branches, with 8 CRS per branch

Combining the data on the revenue (cost savings) and investment sides in Table 3, the static view over one year of operations is that both the SMS and GPRS-based technology channels for remote data collection have positive returns on investment (RoIs). The return on the SMS-based system in particular is reasonably high at 9%, and comparable with other financial investments. However, these figures do not include corrections for the opportunity cost of the capital investments, or the real value of the returns over time.

Table 3: Return on Investment (RoI)

	SMS-based system	**GPRS-based system**
Fixed investments	1,280,000	1,268,000
No. of CRS	104	104
Revenue generated (through cost savings)	342,260	312,620
Operating costs	226,690	287,040
Profit ^	115,570	25,580
Return on Investment	**9.03%**	**2.02%**

^ Profit = [Revenue generated through cost savings] – [operating costs]

Table 4 presents a more dynamic view of the returns on such an investment vis-à-vis the investments made. The NPV of the project over 6 years of operations (the estimated time when a replacement of technological investments in mobile phone devices and PC components can be expected), is negative. What this means is that over a 6 year time-frame, we can only expect to recover around 44% of the up-front investments in the SMS-based system and 10% of the investments in the GPRS-based system in present value terms through cost-savings. Clearly, under the present assumptions of input costs and expected revenues from the introduction of technology in front-end operations, neither of the proposed technology-enabled data collection and management channels is financially feasible. *Though the implementation of both these systems will deliver profits in the form of cost savings, the*

profits generated through cost savings will not be sufficient to recover the heavy initial investments over a reasonable timeframe.

Table 4: Net Present Value (NPV) of technology-enabled systems

	SMS-based system (Rs.)	GPRS-based system (Rs.)
Estimated future streams of profit assuming annual inflation at 5.5%		
Year 1	115,570	25,580
Year 2	121,926	26,987
Year 3	128,632	28,471
Year 4	135,707	30,037
Year 5	143,171	31,689
Year 6	151,045	33,432
Present value of future profit using an OCC (opportunity cost of capital) discount rate of 10%		
Year 1	105,063	23,254
Year 2	100,765	22,303
Year 3	96,643	21,391
Year 4	92,690	20,516
Year 5	88,898	19,676
Year 6	85,261	18,871
Present value of Total Profit expected over 6 years	569,320	126,011
Total Fixed Investment	1,280,000	1,268,000
NPV of the project	**-710,680**	**-1,141,989**
Share of investment recoverable over 6 years' profit	44%	10%

III Sensitivity Analysis

Given that our analysis is based on average estimated prices and quantities of various inputs, it is useful to know how sensitive our conclusions on system cost-effectiveness are to changes in key input prices. For instance, to what extent will having an increased scope of operations, in which these technology-based data delivery channels are used to handle operations other than just new client information collection, result in the intervention being viable. We examine variations along a number of key input dimensions below.

a) Device cost

Clearly, the heaviest investment in these systems is the cost of the field device itself. The question to then ask is what price of field data entry device can be viably recovered in a reasonable time frame from the transaction cost savings ensuing from these technologically-enabled systems for the given tasks.

Table 5: Sensitivity of financial viability to device cost

	Pessimistic		Average case		Optimistic	
	SMS	GPRS	SMS	GPRS	SMS	GPRS
Field device cost (Rs.)	20000		12000		4000	
RoI (%)	5.45%	1.22%	9.03%	2.02%	26.27%	5.87%
Share of fixed costs recoverable over 6 years' profit (%)	27%	6%	44%	10%	129%	29%

When the cost of the field device drops to Rs. 4000, the RoI for the SMS-based system starts to look quite attractive at 26%, with a positive NPV of Rs. 129,286. This means the expected payback period for the investment in present value terms is around 5 years, which begins to approach viability. It is interesting to note that there are indeed several mobile phone handsets on offer in the Rs. 4000 range or less. However, the functionality of these low-end phones is very limited, and they do not offer the capacity to either locally store third-party applications/ data or allow for Graphical User Interfaces (GUI) for ease of data entry in such intensive field data-collection scenarios.

b) Local cost of labour

The sensitivity of our calculations to changes in labour cost is shown below. Should we expect all labour costs to double, while technology costs stay around the same levels (in reality we can expect the relative price to shift more dramatically given the continually falling costs of technology), the SMS-based system nets returns of 22%, which yields a positive NPV and a pay-back period of just around 6 years. Higher labour costs clearly shift the balance in favour of technology-enabled channels in this case because the labour of the DEO is entirely replaced under the new data collection channel.

Table 6: Sensitivity of financial viability to labour cost

	Pessimistic		Average case		Optimistic	
	SMS	GPRS	SMS	GPRS	SMS	GPRS
Labour cost per DEO per month(Rs.)	2000		4000		8000	
RoI (%)	2.48%	-4.59%	9.03%	2.02%	22.12%	15.23%
Share of fixed costs recoverable over 6 years' profit (%)	12%	n/a	44%	10%	109%	75%

c) Productivity of back-office staff

While varying productivities of field staff (CRS) in entering client data can be expected to influence the efficiency of all channels, the productivity of the back-office staff in entering data for the second time has a direct effect on the viability of a technology channel that eliminates the second round of data entry. When the labour employed in the back-office is highly productive, the returns on a technology investment that eliminates that leg of operations saves little. On the other hand, if back-office staff take

30 minutes to type up each CPF at current monthly salary rates, the SMS-based channel shows returns of 24% with a pay-back period of less than 6 years.

Table 7: Sensitivity of financial viability to labour productivity

	Pessimistic		Average case		Optimistic	
	SMS	GPRS	SMS	GPRS	SMS	GPRS
Productivity of DEO (time in mins taken to type up 1 CPF)	5		14		30	
RoI (%)	0.61%	-6.48%	9.03%	2.02%	23.99%	17.12%
Share of fixed costs recoverable over 6 years' profit (%)	3%	n/a	44%	10%	118%	84%

d) Scope of device use

Greater scope of use could be achieved by either using the same field device to collect additional data (transaction data in addition to client profile data for example) from the same set of customers, or perform the same data collection task (client profile data collection) using a single device across a wider set of customers. In the context of Ujjivan's work flow, for smaller amounts of data, clearly the SMS-based system presents comparatively higher returns to investment. However, as the amount of data transmitted increases, both the SMS and GPRS-based systems display lower returns to investment. The inference is that for larger sets of data, aggregated transfer by manual channels (stacks of paper forms that are couriered back and forth) might still be the most cost-effective option given the wireless connectivity cost-context in India today.

At the same time, if we were to achieve an increase in the scope of the device's usage without a corresponding increase in the wireless data transfer requirements (e.g. electronic collection of more extensive data in the field, and upload to the server via a USB-plug in cable from the mobile phone – please see the MSR India case study on BASIX for more details), we can expect the viability of the electronic front-end channel to increase dramatically.

Table 8: Sensitivity of financial viability to scope of device use

	Pessimistic		Average case		Optimistic	
	SMS	GPRS	SMS	GPRS	SMS	GPRS
Data to be transmitted per CPF	160 bytes	Upto 10 KB	800 bytes	100 KB	8 KB	1 MB
RoI	9.13%	4.23%	9.03%	2.02%	7.93%	-20.13%
Share of fixed costs recoverable over 6 years' profit (%)	45%	21%	44%	10%	39%	n/a

In summary, the simple extensions of Ujjivan's current cost scenario presented in this section show us how the viability of technology-enabled front-end data management channels can be expected

to increase as device costs (for a given set of functionalities) fall, labour costs rise, labour productivity/ efficiency decreases (i.e. complexity of the task to be performed manually increases), and as the scale and scope of the device's use increases (conditional on data transfer costs).

IV Conclusion

This pilot investigation began with a simple view to implement a technology-based front-end data collection and management channel that would improve upon and streamline an urban MFI's existing manual front-end client profile creation system. However, running a basic set of costing exercises has shown the potential gains from the proposed channel to be marginal compared to the investments required. Neither of the mobile phone-enabled channels investigated (SMS- or GPRS-based) seems to be financially viable over a reasonable timeframe in the present implementations. The heavy investments called for in building and maintaining the technology-enabled front-end data delivery channels dilute the benefits of cost savings from the use of the new channels (partly due to the efficiency of the existing manual systems and the low cost of labour). However, the sensitivity analysis shows how small changes in input prices or workflow processes can have potentially large effects on the viability of the technology-enabled data collection and management channel over time. The assessment, therefore, leaves us with some useful heuristics by which we can evaluate when and how the use of technology delivery channels for remote microfinance data management can be cost-effective.

This feeds into the broader effort to understand under what conditions technology interventions can augment poor households' access to and use of quality financial services at lower prices and with greater convenience. While ongoing explorations in the realm of electronic payments, transfers and PoS device/ mobile phone-based banking are exciting, it is important to continually measure how these new technology channels deliver cost-savings to providers and/ or monetisable benefits to low-income customers that will ensure long-term financial viability. Technology for technology's sake will not help transform financial service delivery to the poor. Only when the gains from technology-enabled channels are measurable and replicable will such innovations be able to progress beyond pilot undertakings and benefit the greatest number of low-income microfinance clients in various contexts. We therefore encourage further research along these pragmatic lines.

[i] The SMS-server set-up described here was developed at Microsoft Research India (Sean Blagsvedt, Vibhore Goyal, Rajesh Veeraraghavan) and was first deployed in the field in a pilot project with the Warana Sugarcane Cooperative. See Veeraraghavan, Rajesh, Naga Yasodhar and Kentaro Toyama. (2007) "Warana Unwired: Mobile Phones replacing PCs in a rural sugarcane cooperative." Second IEEE/ACM International Conference on Information and Communication Technologies and Development, Bangalore, Dec 15-16, 2007.