

Claim Mobile: When to Fail a Technology

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ABSTRACT

This paper looks back at the deployment of Claim Mobile, a smartphone-based data collection application developed for a non-governmental organization (NGO) in Southwest Uganda. This NGO subsidizes health facilities by paying for medical services on the basis of claims submitted after the patient consultation, targeting treatment of 99,000 clients between 2006-2011. I successfully tested Claim Mobile in Summer 2008, processing 35 claims over two weeks, and then discontinued it six months later, when it became apparent that integration and scale-up of the technology would be problematic for the NGO. In addition, many issues we hoped to address through technology had been addressed through program management changes instead. I find that a) the context motivating the technology changed over time, b) simpler solutions can be as effective as new technologies, and c) prioritizing the needs of the NGO required abandoning the deployment of Claim Mobile. Thus this paper presents the value of learning from *failure* in the process of designing for users in developing regions.

Author Keywords

HCI4D; ICTD; failure; mobile phone; braided communications; SMS

ACM Classification Keywords

H.5.m [Information Interfaces and Presentation]: Miscellaneous.

General Terms

Management; Design; Reliability; Human Factors.

INTRODUCTION

The road to hell is paved with good intentions. – a proverb

Information, communications, technologies for development (ICTD) researchers endeavor to use information technologies (ITs) to disrupt the pace of development. We use the term “leapfrog” to propose that some countries might be able to skip over the tedious and

expensive (and already outdated) process of introducing landlines, and directly move to cellular/mobile communication [10]. As human computer interaction for development (HCI4D) researchers, we emphasize the importance of context and ‘understanding the user needs’ when designing our interventions, suggesting that effective application of participatory and user-centered design methodologies will lead to technologies that will work in challenged contexts [12,19]. Years of research shows that the introduction of new technologies is anything but simple; however, we still hope that the introduction of technology will speed up human development in a way that more traditional aid-based development programs have not been able to achieve [3,9,1].

It is with this understanding that I began a research collaboration with the Uganda Reproductive Health Voucher Project (RHVP), partnering with a non-governmental organization (NGO) to use mobile phone technology to improve form processing, to address communications gaps, and to better understand social dynamics around the introduction of new technologies¹. While the needs assessment and initial pilot deployment of my proposed technology generated positive results [8] it became apparent over the course of subsequent fieldwork that *integration* and *scale-up* of the pilot would be problematic. Furthermore, the NGO had addressed key inefficiencies in communication I had hoped to address with a mobile phone application, by changing their program management practices in the meantime.

In the remainder of this paper, I will discuss the circumstances around the development, deployment, and ultimately my choice to ‘fail’ Claim Mobile. I suggest that 1) the suitability of interventions for a particular context may change over time and 2) simpler technologies and program management techniques are often more suitable than the complicated new technologies intended to replace them. The RHVP was able to address inefficiencies in their program with their own solutions more effectively than with Claim Mobile. Furthermore, I propose that

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¹ Since this paper is in regards to my personal experiences and choices as a researcher, I choose to write this paper in the first person. While a royal ‘we’ absolves me of responsibility for my actions and decisions, the use of the ‘I’ acknowledges my personal role. On occasion, I will use ‘we’ to acknowledge instances in which colleagues and research assistants also contributed to this study.

appropriate user-centered design should go beyond design of technology, and allow the *option of failure* for the proposed technology.

BACKGROUND

The Reproductive Health Voucher Project

In theory, healthcare in Uganda is free. Patients can go to government health facilities, see a health worker, and receive drugs for treatment. If necessary, they are referred to a local hospital for specialist treatment. However, in reality, seeking treatment at a government health facility entails walking up to 10km, often to find that the health worker has gone for training or then waiting several hours to find that the facility is out of stock. As an alternative, many Ugandans choose instead to seek treatment from private alternatives – either herbal remedies during lean times, or from private health facilities when more money is available [13]. The result is that many health conditions go untreated for long periods, or mothers or infants die unnecessarily in childbirth. NGOs often address these issues by opening free or subsidized health facilities. However, these programs are often expensive and under-utilized.



Figure 1: Patients purchase bar-coded vouchers from a distributor given to health service providers (HSPs) in exchange for treatment. The HSP then returns the voucher on a claim form to the RHVP management offices to be reimbursed for the treatment given.

The Reproductive Health Voucher Project (RHVP) was initiated in 2006 to address the gap between input-based financing and service provision by subsidizing treatment of sexually transmitted infections (STIs) and antenatal and child delivery services through private and NGO-funded health facilities. Patients purchase vouchers from community-based distributors (CBDs) for 3000 UGX (~1.50 USD²), which are then given to health service providers (HSPs, i.e. the health facilities) in exchange for treatment. The HSPs then submit the voucher and a paper

copy of the patient visit record to claim payment for the visit from the RHVP management agency (MA).

While this program held a lot of potential, Claim Mobile's purpose was to address a few issues inherent to the program design. This primarily paper-based process entailed a lot of paperwork, and was subject to significant user error, with financial penalties entailed. With frequent power outages and varying mobile phone network coverage one of the primary ongoing issues in the project was communication between the MA and the HSPs. The MA often resorted to in-person visits to follow-up on or verify information communicated over the phone. However, the program involved people from a widely dispersed geographic area, including the head office of the MA in Kampala, the capital of Uganda, 270km northeast of Mbarara, the trading town around which most of the project is based, and where the project offices are located. In-person visits to health facilities were costly and time-consuming.

Claim Mobile

Claim Mobile had two components, a web server and mobile application. The web server served as the repository for all of the claims, and the main interface for the management agency and their partnering stakeholders. Depending on computer and Internet availability, HSPs could use either the mobile phone application or the website to enter and access their own claims. For detail beyond what is described here, please refer to [8].

Features

One of the primary features of Claim Mobile was **claims submission**, the ability for HSPs to enter and send claims to the MA, and for the MA to then review and make payments on the claims. The initial needs assessment (2007) revealed that problematic paper claims usually entailed incomplete or inconsistent claims. Prescription drugs given did not match lab diagnosis results. Vouchers, date of treatment, and even patient demographic info was missing. Fees were recorded and calculated incorrectly. We addressed this by using pre-filled checkboxes to reduce text entry, limiting answers to valid options, and pre-calculating reimbursement amounts. This also aided HSPs by educating them on proper treatment protocols.

HSPs felt disengaged from the RHVP program because they often did not know whether their claims had been approved in a timely manner, or which claims had problems. I attempted to **close the feedback loop** by enabling status updates on each claim. As various people in the MA reviewed the claim, the status would be updated. Should it not be approved, the HSP and the MA could use the feedback feature to discuss the status of the claim, retaining an audit trail of all queries in the database.

In addition to queries about particular claims, HSPs often needed to ask general questions usually regarding payments, availability of forms, or the outreach programs.

² The Uganda Shilling (UGX) to US Dollar (USD) conversions are given throughout this manuscript at a rate of 2000UGX:1USD. During the study period the actual exchange rate ranged from 1700 to 2250 UGX:USD. Source: Bank of Uganda, <http://www.bou.or.ug>

In addition, the MA frequently needed to communicate with the HSPs either calling them individually, or delivering letters to them physically using their trucks. These interactions were time consuming and expensive. To address these needs, Claim Mobile also integrated the ability to **send messages and announcements** between the MA and the HSPs. The web interface included details and contact information for the HSPs, enabling the MA to send messages to the HSPs individually or as a group or subgroups.

Integration

At the outset of this collaboration, the RHVP had an existing claims process, including an Oracle-based database, in which all of the paper claims were entered. To simplify the user experience for the HSPs, the paper-based claim form, the mobile claim form, and the web-based claim forms were all largely the same, retaining the same titles, structure, and information. Likewise, I modeled the underlying structure to facilitate integration with their existing database, as well as to any other standard database. I also established strong ties with the third party company that provided the claims processing service and software on behalf of the MA, which gave me confidence that I would be able to integrate our software into theirs.

Limitations

Claim Mobile's primary requirement was network connectivity. I chose to depend on the availability of GPRS (general packet radio service, Internet over mobile GSM), having done a site survey of all of the then-participating HSPs (12), and verified availability of Internet in each of them. While data connectivity over SMS was also a technical option, we deemed it more expensive (~2 bytes/UGX vs. 1 KB/UGX), and unnecessary at the time.

Given the small screen size, and the tedium of entering data into a phone, it was apparent that the single A4 page that comprised the claim form was approaching the limits of the length of form that a phone should accommodate. We addressed this issue by breaking it up into components, reducing typing as much as possible, and introducing branchpoints into the form logic where sensible. However, it was my assessment that the users would not have patience or time to deal with lengthier forms on this mobile phone; longer claims would require devices with larger screens and a different mode of data entry.

As a researcher, I also had another limitation. Balancing fieldwork with class schedules, funding and the needs of the collaborating institution entailed negotiation with advisors, granting institutions and the NGO. While a grant for the needs assessment funded the first two visits, additional funding and academic requirements precluded another visit until the following year. In the meantime, the NGO project continued to run, and even terminated briefly. Finally, I decided to conduct an extended field study, flying once to Uganda and staying for a year instead of making several

short trips. In the intervening time, the NGO had expanded services to 52 HSPs, significantly more than the original 12 that I had planned for a deployment. With a budget and a time limit, I was unable to scale the Claim Mobile research to provide mobile phones for each HSP. Furthermore, with the additional HSPs, the NGO was swamped with many more claims than before, and did not have time for integration of the system.

An Evolving Research Scope

I was initially invited in 2007 by the RHVP's management agency to examine the possibility of using smartphone-enabled digital forms to reduce some of the delays around receiving and processing claims. After a needs assessment in July and November 2007, I conducted a five-week deployment of a mobile phone system for processing claims in two health facilities (August 2008). In this pre-pilot, I simulated the proposed process, and the HSPs submitted claims on the phone in parallel with paper claims [8]. Each visit entailed semi-structured interviews with staff at various levels of the RHVP, as well as direct observation of the claims form entry and processing. In addition to studying the functionality and usability of the system, I endeavored to understand how the use and introduction of ICTs within the HSPs improved the program management within the project. While the pre-pilot was largely successful, it became apparent over the course of subsequent fieldwork that *integration* and *scale-up* of the pilot would be problematic, due to reasons I will detail later in this paper. As with many development projects, the RHVP was constantly evolving; it was necessary also for my research to evolve in response.

In early 2009, *integration* of the mobile claims processing software for just 8-12 of the (at the time) 83 HSPs into the claims process of the NGO would be disruptive to their own programs, due to changes in circumstances. At the same time – there was interest in and demand for a better mechanism to manage SMS (text) message communications between the HSPs and the NGO staff. While this was initially a feature in Claim Mobile – the time frame, scale of the deployment and platform did not match the needs of the NGO, and they decided to outsource an independent bulk SMS platform to a third party vendor in Uganda [4]. Thus this research also incorporates the study of the development and deployment of a third party bulk SMS platform, designed based on recommendations and requirements co-crafted by the researcher and the collaborating NGO.

METHODS

My placement with this NGO extends over three years of field visits, beginning with an initial site visit in June 2007, followed by three 1-6 week visits, culminating in a 15-month field study from January 2009 to April 2010. On each visit I witnessed vast changes in both the NGO's overall program management, as well as the overall Ugandan communications infrastructure. Mobile and

Internet infrastructure was advancing rapidly, and not only was I able to see it, but I was forced to adapt to these changes in order to effectively communicate with the NGO staff and the HSPs.

A Multi-Disciplinary Approach

In order to collect a rich understanding of the context during my study, I chose to use mixed methods approach, allowing quantitative and qualitative results to inform one another as I proceeded through the research. Table 1 gives an overview of research activities conducted at the field site. This research has spanned a period of about four years, with 17 months spent in Uganda over five visits.

Timeline	Activities
June/July 2007	Initial Site Visit (2 weeks)
November 2007	Needs Assessment (2 weeks)
August/Sept 2008	Planning and Pre-Pilot (6 weeks)
November 2008	Additional Fieldwork (1 week)
Jan 2009 – Apr 2010	Extended Fieldwork (15 months)
- August/Oct 2009	Baseline Surveys
- Nov 2009-Apr 2010	SMS Software Study

Table 1: Timeline of fieldwork activities conducted in Uganda.

I conducted a site survey in 2007, collecting data from all 12 of the health service providers (HSPs) on available infrastructure and interactions with the NGO. I followed up this survey by conducting semi-structured interviews with 8 of the HSPs. From September – October 2009, I conducted a second survey, assessing their usage of ICTs and communicative relationships with the NGO. In this survey, I collected data from 59 out of the then-participating 83 HSPs. Twenty of these surveys were conducted as semi-structured interviews, with quantitative data recorded on the paper surveys. The remaining interviews were conducted as structured surveys.

In addition, I used my computer science background to establish myself as an “IT consultant”, in addition to my acknowledged position as a researcher, working at the offices of the NGO and assisting as necessary to help make information technology (IT) related decisions, and to facilitate communications with the HSPs. I used my time to observe NGO life, and the interactions of the staff with one another and the HSP staff. I also worked with the doctors, midwives, and other health practitioners that were *in charge* of the HSPs (ICs), observing their work, and training them on the use of ICTs. I conducted periodic interviews with the ICs and NGO staff, both conversational and semi-structured, to elicit a better understanding of my observations.

A Study of Change

At several points during my fieldwork, I introduced new technologies, or the idea of new technologies. In particular, I piloted Claim Mobile to two HSPs in August 2008, and provided netbooks and Palm Treos to eight HSPs in January 2010. In both cases, the decision to deploy the technology

involved extensive discussion and study with the parties involved beforehand, during, and after. I also observed the adoption of *in situ* technologies, including increased use of mobile phones, SMS (text messaging), and the deployment of a web-based bulk SMS system.

While all ethnographies entail some level of disruption [15], I chose to explicitly disrupt the context of the NGOs and the HSPs by introducing new technologies and observing the ways in which they reacted. While Claim Mobile was put forth as a means of improving the efficiency of program management, it was also for me a cultural probe [6], by which I could better understand the contexts of an ICTD project.

Comparable methodologies include participatory design and ethnographic action research. Participatory methods are central to Braa’s work in deploying health information systems [1]. Tacchi further suggests ICTs exists in a *communicative ecology* of many interrelated people, media, and relationships [16]. Likewise, I conducted my research involving Claim Mobile with the understanding that it would exist in a rich ecology of stakeholder relationships and practices [8]. Iterating over the steps of planning, interaction with the users, and implementation are important aspects of developing projects grounded in reality and user needs. However, as a key difference, the *project*, while important, does not form the basis for the research. Instead, the basis for this research was the changing NGO context as I introduced and they approached new information technologies. The *project*, in this case, was a tool by which I could trigger a specific type of change, and examine the results. The conditions around Claim Mobile’s introduction and non-adoption helped me develop a richer understanding of the role of new information technologies in Ugandan healthcare.

CHANGING CIRCUMSTANCES

After having carefully evaluated a number of potential partners, and also having conducted a survey of the needs of the user base, I felt confident collaborating with this NGO on this project, and hopeful that our invited technical solution would be of benefit. However, between 2007 and 2010, the RHVP program experienced a number of dramatic programmatic and structural shifts, all of which had significant impact on the potential viability of Claim Mobile.

Stakeholder Structure

When the RHVP program began, the NGO outsourced claims processing to a third party agency, since they had no expertise in computer systems. This third-party organization, the claims management agency (CMA), developed a database system, including a mechanism to read the barcodes printed on the vouchers. Barring some minor hiccups, this was an extremely functional relationship throughout 2006-2007.

When my research started, I was collaborating with two organizations: a health NGO program with many communications bottlenecks, and a highly technical CMA with an interest in using communications technologies to improve their own insurance business. The NGO presented a clear development context, and the CMA presented a mechanism for smooth integration and technology transfer.

However, in the latter half of 2008, this relationship began to break down. One of the key disputes the NGO had with the original CMA was over ownership of the claims management database system. The CMA insisted that the software was available *on license* to the NGO, while the NGO insisted that any software developed with money from the Ministry of Health (MoH, i.e. the Ugandan government) legally belonged to the government in perpetuity.

By November, the NGO and the CMA had severed ties, and the NGO was processing claims by entering partial review information into Excel spreadsheets. This method was prone to error, and more susceptible to potential fraud. Furthermore, donors and external reviewers felt this was inadequate for evaluation purposes. To address this, the NGO requested proposals for a new claims processing software vendor. I flew out in November 2008 to participate in the bid evaluation, and to meet my potential new collaborators. When establishing a relationship with the new vendor, the NGO made it clear that any software they developed would belong to the RHVP and the MoH. They also hired a Ugandan IT consultant to act as a liaison between the NGO and the new claims management software vendor (CMSV). Eventually, despite the tight three-month deadline we set in the initial proposal, this software would not be launched until late December 2009.

The replacement of the software vendor also changed my own role in the RHVP program. I had significant support from the NGO's donors for the mobile platform, and the NGO wanted to be the place where it was tested successfully. However, the claims ultimately needed to be put into a database. With the original CMA, I had already worked out plans to integrate with their claims management software. However, since the new software vendor was providing only the software, and not claims management services, they had no incentive to test out innovations, especially given that the software release was already late.

New Programs, Shifting Priorities

When I first began working with the RHVP program, it had a different name, and was only financing treatment of STIs in 12 health facilities. As with many donor-funded projects, the initial grant came up for review after it was spent. Since the 'pilot' voucher project was judged to be successful, the donor chose to expand the program, adding maternal delivery services, and asking the NGO to expand geographical coverage from four districts to 22 districts encompassing all of Southwest Uganda. To finance this, the

donor collaborated with the NGO, applying for a grant from a multinational granting organization, eventually getting \$6.4M (5.96 for the delivery program). Based on their cost expectations at the time, the donors expected the NGO to finance 50,000 deliveries, and 30,000 STI vouchers over the next three years (Table Table 3).

The new maternal delivery (MD) voucher program was quite different from the STI voucher program. First of all, the Ministry of Health was strict about treatment and tracking requirements around births, requiring significantly more documentation than was required for the STI treatments. MD vouchers entailed four antenatal visits, a delivery, a postnatal visit, potential transport, and referrals over the course of ten months. While the STI claim form consisted of a single 8.3" x 11.7" A4 sheet, the MD claim forms consisted of five different forms, most of them using 16" x 11.7" A3 sheets. In addition, while treatment of STIs might be a high volume service, with hundreds of treatments per month per facility, deliveries constituted a low volume service, with tens of deliveries per facility per month on average. In exchange, the average STI voucher paid \$US7-15, while the average delivery paid \$US58. Most of the STI HSPs, even the new ones, were located within a few hours drive of Mbarara. However, in order to find sufficient qualified HSPs to provide maternal delivery services, the RHVP expanded delivery voucher services much further, contracting three times as many HSPs in the delivery program as in the STI program (See Table 2).

	June '07	Aug '08	Jan '09	Sept '09	Jan '10
STIs	12	12	0	37	25
Delivery	-	-	52	52	81
Total	12	12	52	83*	106*

Table 2: Health Service Providers contracted by the RHVP program from project inception to January 2010.

*note: some HSPs participated in both the STI and the Delivery voucher programs.

The 2006-2008 STI voucher program was called a pilot of the voucher program, and yet, implementing delivery vouchers was so different that it was almost like starting again. With the launch of the MD program in September 2008, the NGO abruptly shifted its focus, putting all its efforts into making sure the new program worked well. At this point, the STI voucher program was put on hold. The NGO stopped distributing vouchers, not resuming the program again until September 2009. Donor consciousness seemed to support this move initially – a significant proportion of the money was allocated towards the MD program. Target expectations around the STI program were also low, just 50% more than their previous pilot, even though they had twice as many participating HSPs. In the short term, the NGO was also far behind donor expectations, with only 4,700 mothers delivered out of the targeted 10-15,000 by December 2009. (See Table 3).

The hiatus of the STI voucher program had the most immediate impact on Claim Mobile's deployment. It was impossible to survey users or deploy a system for a client

base that did not exist. I considered also shifting the focus of Claim Mobile to include delivery vouchers in its scope. However, the MD forms were simply too long and complicated for the mobile phone – it would be too tedious for the user to enter that much data, given the small screen size and keyboard on the phone. Furthermore, the NGO staff was focused on scaling up their program, while I only wanted to work with a few HSPs, to get a more detailed understanding of their interactions with the technology. Our objectives would be at odds, at an extremely critical point for the NGO. It was my choice to prioritize the NGO’s actual technology needs over the research agenda entailed in Claim Mobile’s wider deployment.

	<i>Aug '08</i>	<i>Dec '09</i> <i>15 mo</i>	<i>Sept '10</i> <i>24 mo</i>	<i>Target</i> <i>36 mo</i>
STIs targeted	19,000	17,000 (10,000)	50,000 (20,000)	30,000
Delivery targeted	-	4,700 (15,000)	30,000 (30,000)	50,000

Table 3: Vouchers sold.

Infrastructure Availability

The increase in the number of HSPs was motivated by the need to generate more voucher usage, and also entailed broader geographic coverage, and new geographies. Visiting newly added health facilities now entailed overnight travel for the NGO staff, and many did not have electricity, or good mobile network coverage.

The network communications infrastructure in the country was also changing. Warid Telecom launched in Uganda in January 2008, and Orange launched in March 2009. More competition resulted in new services and reduced prices.

At the local level, new funds enabled the re-launch of the voucher project, and also came with funds for new infrastructure. The NGO purchased new trucks for visiting HSPs, invested in new software, and upgraded the Internet, all in the name of improving RHVP program management. In this section, we discuss the changing infrastructure availability and its effects on claims management.

Mobile Internet

When this project began, Palm Centros and Palm Treos qualified as ‘smartphones’, on the basis of their ability to browse the internet and run advanced applications. Palm’s long history of use by medical practitioners also meant that the phones had medical applications available [5]. While I had deliberately chosen Java 2 Mobile Edition (J2ME) as a platform for Claim Mobile’s phone interface for its portability to other phones, when Android and iPhones came out I decided not to switch to the new devices. I decided that the PalmOS-based phones were more affordable, and less costly with respect to Internet use. While newer smartphones generally require unlimited monthly subscriptions to the Internet, the Palm phones only downloaded data when the user requested it, and its programs used protocols that conserved bandwidth and

bytes. Since I expected eventually for the HSPs to pay for their own Internet use and airtime, I wanted to be cognizant of both the infrastructure availability then available in Uganda and the costs associated with mobile Internet use.

Even in retrospect, this was a wise decision. While Centros and Treos need to be charged once every three days, most Android-based and even newer WebOS-based Palm Pres need to be charged daily. In my survey HSPs expected phones to have a minimum of three days of battery life. In practice, I found this useful, merely to ride out unexpected power outages. Even beyond the issue of electricity were the combined issues of mobile Internet availability, technical training, and affordability. In January 2009, when I returned to Uganda, a monthly subscription to mobile Internet cost 85,000-90,000 UGX (~45USD). My baseline surveys showed that HSPs spent an average of only 20,000 UGX on phone services. To ask them to spend an additional 85,000 UGX seemed unreasonable. However, in March 2009, a new mobile provider, Orange, launched its services in Uganda. A few months later, Orange had 3G mobile Internet services available in all of the major Ugandan cities, and GPRS in many places in between. Their tiered plan started at 49,000 UGX/month (~25USD). Eventually my research subjects would all purchase modems and subscribe to this plan, using the service to connect their computers, but not their phones, to the Internet. I found that, while it was possible to get voice phones with data plans (indeed, Orange began offering the iPhone in Uganda in December 2009), most of the data SIMs³ have been encoded specifically to only work for data, and do not also allow voice communication. Enabling phones with voice and data generally requires a bit of tech savvy and willingness to negotiate with customer service representatives for SIM cards with appropriate configurations.

Now the Palm phones have waned in popularity, and mobile health providers have shifted their focus to newer platforms. However, these constraints have implications for the design of future mobile phone technology. At present, most phones are either low cost or fully featured. Deployments using iOS and Android phones and tablets need to address initial cost, maintenance, battery life, and mobile Internet availability.

Using Existing Technologies Effectively

Over the course of my extended fieldwork, the NGO staff became more and more acclimated to the use of the Internet and mobile phones. They started using and sharing phones to call the HSPs regarding problematic claims. They also called one another, either between the Kampala and Mbarara offices, or when someone was in the field. SMS

³ SIMs (aka Subscriber Identity Modules) are the small chips that can be placed in a phone or a modem to identify itself (i.e. its IMSI, mostly equivalently, it’s phone number and host service provider) to the network.

(text) messaging also came into popular use, with HSPs contacting the project coordinator to ask for more claims forms, or to ask about recent payments. In the Kampala office, they used GPRS modems to connect their computers to the Internet when their VSAT (satellite) connections went down. Skype and Yahoo! Chat started to come into use, and the program director (PD, the head of the RHVP program) mandated the use of Skype in both offices, as a cost-cutting measure. While the Internet connection in the Mbarara office was not fast enough during the day to support a reliable voice call, Internet chat was less expensive and disruptive than mobile phone calls.

Many of these technologies were already available in 2007. The staff of the NGO merely became more familiar with the ways they could be used, both in general, and in the context of the project. They started primarily with paper-based and in-person communications, supplementing short phone calls with surprise visit inspections. In addition, they used broadcast radio to educate potential clients about the program, advertising the HSPs and the voucher distributors (usually local pharmacies). As they expanded their services, they began relying more on their drivers and their trucks. Where before, the trucks were used primarily to conduct village outreaches (movies advertising the RHVP project), they also started asking the trucks to visit nearby health facilities to pick up and drop off claims forms and communications, rather than waiting for ICs to visit the Mbarara office to pick them up. Informally, the HSPs learned the personal mobile numbers of the project coordinator (PC) and the finance officer (FO) that handled their payments. Anyone that felt disengaged or neglected just called the appropriate person and asked, "Where are my payments?" Many of the newer HSPs were supported by other NGOs, and had 24-7 Internet available in their facilities. The PD and PC began conversing with key staff at these HSPs by email, in addition to paper, SMS, voice, and in-person communications. Over time they learned that each communication channel had different *affordances*. Paper letters were the most formal, generally occurring on the NGO letterhead, and requiring signatures. Voice and in-person communications were convenient, allowing *exchange* of information. However, the PC found that, without documentation of the information exchanged, various parties could retract statements easily. He began asking HSPs to send SMS messages, write emails, and write letters reiterating what they had said on the phone, and asked the other NGO staff to do the same. It became a mantra in the office: "Get it in writing!" While this was less critical with regards to requests for new claim books, it was absolutely critical with regards to handling of complicated claims, often involving reimbursements of 50-150 USD. All of these measures, perhaps in response to the feedback from my 2007 site survey, combined to greatly improve relations between the HSPs and the NGO.

The Failure of E-mail

In September 2009, the NGO had their drivers deliver a letter to each of the HSPs participating in the delivery program, asking them to contact the PC with their e-mail address, mandating that they create an e-mail account and check with at a minimum monthly if they did not yet have one. The NGO staff suggested that e-mail would be a more convenient and cost-effective means of delivering claims reports to the HSPs than having their drivers transport them personally by truck. The delivery route, using three trucks, generally took one month, but a minimum of two weeks to cover all 83 HSPs. During that time, the NGO paid for fuel, and living expenses (~25 USD/person/day) for two staff per truck on top of their normal salaries. E-mails would be virtually free. Furthermore, they suggested, they could write more casual communications than those entailed by letters. A few months passed, and it transpired that it was not feasible for the more rural HSPs to check email on a regular basis. The effort of regularly checking the accounts was too much. Checking email required travel to a nearby town to visit an Internet café, asking the manager to help open the account, and paying for both the service and the travel. As often as not, the café would be closed due to power outages or network outages. It was too much work given the possibility of only 1-2 emails per month from the NGO that they could more conveniently reach by phone. Indeed, for some, by the time they had arrived in town, they could also visit the NGO offices in person.

Eventually, the NGO hit upon a working solution: the Ugandan postal service. First, they noted that many of the HSPs already had P.O. Boxes, usually in a nearby town, where the HSP staff already went on a regular basis to pick up medical supplies. Picking up mail at a P.O. Box involved lower overhead than checking email, both in terms of finances and time. In addition, the NGO made a practice of sending an SMS announcement to all of the HSPs each time they mailed out any notices. The HSPs knew when to look for mail, and appreciated that their documents came pre-printed and not just on a computer they could only access in an Internet café. While the information interaction remained the same, the final channel for the claims reports ultimately took on a non-digital form.

The Rise of BulkSMS

In May 2009, I was approached by one of the NGO staff. "What do you think of a system that will allow us to use our computers send text messages to all of our health service providers at once?" Shortly thereafter, the NGO put out an official request for proposals, and by late July 2009 we were evaluating three bids from four organizations, to be paid for by the project donors.

The motivation for the Bulk SMS project stemmed from existing practices. Partly as a result of the 'Get it in writing' policy, the NGO was communicating by SMS with many of the HSPs. SMS messaging served as written and persistent communication channel for securing payment

confirmations, requesting claim forms, and to communicating about issues regarding claims payments. However, all of these messages were scattered across personal phones belonging to the project coordinator (PC), medical advisor (MA), finance officer (FO), and other staff. The program director (PD) needed this information documented for the donors. Manually collecting them from individual phones, and sorting out personal messages from work messages just was not feasible. As an added benefit, a Bulk SMS system would enable the NGO to send broadcast short announcements to all of the HSPs at once, with much less overhead than writing letters, stuffing envelopes, and sending them, at the time, by their drivers.

The selected bidder, a Ugandan company, deployed the software in October 2009, bringing the PC and the project's database manager (DBA) up to Kampala for a training session. Over the next 7.5 months, from its initial launch to June 30, 2010, the system sent 4,167 messages, comprising 250 unique messages. The NGO sent 65 announcements, either using a template or identical messages. In addition, another 134 messages were sent using the Bulk SMS system's query feature, which allowed HSPs to send a message to the system, which would then be relayed to all of the RHVP key staff, including the PC, PD, MA, DBA, and the FO. The appropriate person would then respond to the HSP, either directly, or using the system (Figure 2).

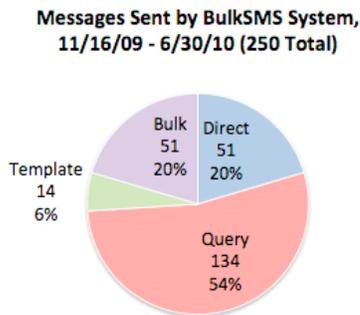


Figure 2: Breakdown of individual messages sent by the BulkSMS System

Messages sent dealt primarily with payments (22%), with a significant number of apologies for late payments and queries about payment timing. However, the NGO also used the system to make program announcements (17%), and to confirm acceptance of contractual changes (7%). In one instance, they mailed a new list of prices to the HSPs' P.O. Boxes, including a written letter asking them to send an SMS to the Bulk SMS system number to confirm acceptance of the prices, in lieu of a signature on a revised contract. The prior September, contract signing for new clinics occurred over a period of three weeks, as three copies of the contract booklet traveled from each HSP back and forth to the NGO offices for additional signatures and corrections. The introduction of persistence and centralization into the informal mechanism of SMS messaging enabled these users to use this media as a formal

information repository, enabling a more efficient means of administration over a large geography.

ANALYSIS

Time Changes Everything

By now, the ICTD community has developed a common understanding of what might produce successful projects. Understanding local context and user needs may not guarantee success but are necessary components of success. Many groups use *change agents* and *opinion leaders* as local advocates for their technologies, understanding that these community members can be a bridge between outsiders and the local community. However, with the added element of long timespans, these measures may prove insufficient.

A primary change within this project was the addition and subtraction of key stakeholders. The loss of the CMA entailed the loss of a key change agent, and collaborative partner, endangering the potential sustainability of Claim Mobile within the context of the RHVP. The addition of a new granting institution, along with its millions of dollars in funding for the MD program shifted program priorities away from the NGO's original objectives around STI treatment. In late 2009, the RHVP was over 10,000 clients behind targeted expectations for the donors (See Table 3). Between the replacement of the CMA with a temporary stopgap of Excel spreadsheets, then a delayed release of the CMSV's database, all of the staff of the NGO were constantly working through early 2010 to catch up on a backlog of claims to be entered. This situation, combined with the observation that many of the bottlenecks in payments processing that were present in 2007 had been removed, motivated my decision to 'fail' Claim Mobile, despite backing from both my donors and theirs. While the concept of Claim Mobile might still be useful, it was no longer suitable for this changed context.

Appropriate is Beautiful

One of the strengths of the NGO was their core team, which carried over from the initial RHVP pilot throughout the program. This team was adaptable to changes in technology and stakeholder contexts, learning what worked as they went. Likewise, while mobile phones are generally flexible, mobile phone applications are generally rigid. One of the weaknesses of Claim Mobile was that it was designed specifically for the STI voucher. Since it was specific to that particular context, it failed to transfer well to the context of the delivery voucher.

While I have emphasized that mobile phones and text messaging, combined with basic project management decisions (Write it down!), are often better than a more complicated technology, simple is not always better. Small is Beautiful suggests that developing countries will more effectively adopt *intermediate* or *appropriate* technologies, specifying that such technologies should match available

resources and context constraints [14]. However, with ICTs, it is not always clear what constitutes ‘appropriate’ technology. Recognizing user needs requires finding a happy medium between costs, infrastructure limitations, and manageability. We see how simple email technology failed, but even more basic postal service succeeded. BulkSMS as a technology was simpler than Claim Mobile, but more complicated than the SMS usage model that it replaced. At the same time, it simplified life of PC’s personal SMS inbox, and consolidated the RHVP’s SMS messages in a single location.

Braided Communications

Information technology encompasses radio, satellite, television, etc., in addition to computers and the Internet. I also consider the roles of non-microprocessor-based communication mediums, such as postal service, and in-person communications. The NGO used many communications media to support the evolving and heavily logistical relationships with the growing number HSPs it financed. Due to the wide geographic span of the HSPs, the NGO faced a number of structural limitations, including poor road infrastructure, intermittent power, and unreliable mobile network coverage. These stakeholders work together to develop and maintain effective relationships using a number of different communications channels (e.g. delivery trucks, mobile phone, SMS, in-person, etc.) in parallel, a pattern I describe as *braided communications*.

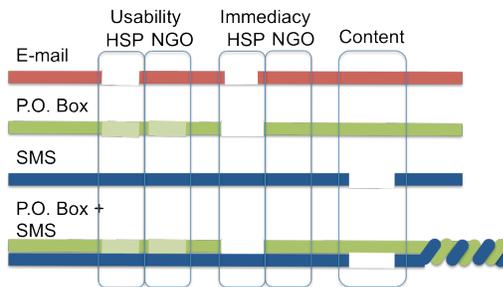


Figure 3: A braid of P. O. Box and SMS communications takes advantage of the immediacy of SMS while also allowing exchange of long documents.

Each mode of communication has particular *affordances*. When used together, the advantages of one can overcome the limitations of each individual mode. For example, a P.O. Box can only be checked physically and are located far away from the HSP. However, since the NGO also sends an SMS notification to the HSP that a letter should be expected, the HSP does not need to check the P.O. Box unnecessarily. In addition, P.O. Boxes are never subject to the network or power outages frequently experienced by rural Internet cafés. In-person and voice communications are interactive and convenient. However, the use of SMS or e-mail can supplement these interactions and help document their results. Braided communications enable the

NGO to use the affordances of individual channels to create more reliable and effective communicative relationships.

Finding What Works

In retrospect, perhaps I could have anticipated that the context would change, and designed Claim Mobile to adapt to potential changes. In that respect, I used iterative methods to design the system, playing close attention to contextual issues [8]. It is actually this attention that enabled me to see that the system was no longer appropriate for the RHVP. While donors supported the concepts behind the technology, the expanded program was no longer appropriate for its study.

As researchers, we are called to look at future technology, technologies that do not work in the field currently, and may not be expected to work for 2-5 years in the future, possibly more. Yet, as ICTD/HCI4D researchers, we examine our future technologies in right-now environments. These environments are often prone to break our interventions, or our technologies are prone to break in these environments. Either way, we scope our research pilots to represent a microcosm of what we expect the near future to look like. I chose two health facilities, deploying Claim Mobile with them. In this environment, I could ask, what would private health practitioners in Uganda do if they possessed Internet connectivity and advanced mobile phones? What might it look like if mobile Internet and devices started to be ubiquitous?

I do not necessarily expect all research pilots to achieve scale. In this case, we saw that when the number of HSPs increased, mobile Internet coverage was no longer ubiquitous, due to differences in geography. Given this tendency, industry or practitioner implementations may be more appropriate and reliable for NGO success. They can produce products within set time frames, and provide ongoing support. At the same time, researchers working with the Warana Wired Village Project improved access to information for sugarcane farmers by replacing a PC-based system with an SMS mechanism [18]. In this case, the researchers documented the failure of the kiosks, and adopted a new, more affordable approach. We must carefully balance expected benefits from our work against the real needs of our collaborating partners. As researchers, we can build an understanding of how new technology approaches will work in these contexts.

I approached my research with the goal of understanding how the introduction of new information technologies changed relationships within the RHVP program. By being willing to step back from Claim Mobile, I learned how broader needs affect particular deployments. Scale, program priorities, and available technologies changed, making a particular angle of research less suitable for the context. Instead, my broader agenda enabled me to identify other creative approaches that the NGO took to address the needs I identified early on.

CONCLUSIONS

In order to successfully forward development, we need to look beyond the immediate success of our specific technologies, and build a better understanding of their long-term workability with respect to their contexts. I suggest that genuine discourse around ethnography in HCI and user-centered design requires *room for failure*. We cannot take it as given that IT is the correct solution for every problem [17], or that a ‘successful’ solution will work in every context. Rather than centering research only on making a system appropriate for the users, we can endeavor to understand our users better, making the system second to their interests.

Researchers can support development organizations. However we must remain cognizant of the changing needs and context, both within the organization, and externally, as available infrastructures change. Appropriate interventions might entail simple or complicated tools. As demonstrated here, some interventions, such as Claim Mobile, may be initially suitable, but fail as the context changes over time.

By giving myself room to fail, I had the opportunity to observe in situ informal uses of mobile phones and texting, and a formal implementation of a Bulk SMS system. Through an extended period of observation, I learned how this organization used and adapted available technologies to their particular context – that the affordances of technologies affected and depended upon stakeholder needs and relationships.

Failure is not new, and has been much discussed in development and ICTD literature [7, 11]. However, we continue to need to learn from one another’s failures, and build on each other successes [1]. While it may be tempting to dismiss failures as foreseeable results of faulty approaches, the future is not always foreseeable, and failure can occur in the best of circumstances. Indeed by choosing to work in developing regions, we are subject to daunting challenges [17]. It is by sharing our experiences and building a better understanding of these challenges that we will succeed at finding effective ways to use information technologies for development.

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