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MOTECH project description

The Mobile Technology for Community Health (MOTECH¹) Initiative is a partnership between the Ghana Health Service, Grameen Foundation, and Columbia University's Mailman School of Public Health, with funding from the Bill & Melinda Gates Foundation. The project uses two interrelated mobile phone applications to increase the quantity and quality of antenatal and neonatal care in rural Ghana with a specific goal of improving health outcomes for mothers and their newborns.

Access to basic health information in rural areas of Ghana is extremely limited, resulting in lack of knowledge about maternal and child health, low uptake of health services, and adherence to often-damaging local myths and cultural practices. This contributes to high maternal and child morbidity and mortality. Therefore, MOTECH has developed the '**Mobile Midwife**' application which enables pregnant women and their families to receive SMS or prerecorded voice messages on personal mobile phones that provide time-specific information about their pregnancy each week. Information is provided in the client's local language and is localized to address issues faced in various regions of the country. The messages continue through the first year of life of the newborn and reinforce well-child care practices and vaccination schedules.

There is also a '**Nurse Application**' that enables Community Health Nurses to electronically record care given to patients and identify women and newborns in their area who are due for care. Previously, this data was collected and aggregated on paper owing to shortage of power and computers in rural health facilities. This resulted in inaccurate data and time delays, so reducing its value for decision makers.

Using the former paper-based system, it was also difficult for nurses to identify clients overdue for care since data was collected in up to thirty different registers. Therefore, MOTECH has linked its two mobile applications so that if a patient has missed treatment that is part of the defined care schedule, the Mobile Midwife service sends an **appointment reminder** to the patient and nurse.

The MOTECH system was launched in July 2010 in one district in the Upper East Region of Ghana and has registered over 7,000 pregnant women and children under five. To validate the replicability of the service, expansion to a district in

Central Region was scheduled for June 2011. A randomized controlled trial in the Upper East Region would be completed by Columbia University in November 2011 to determine the impact of the intervention on health outcomes. In this chapter, we will explore some of the lessons learned in the process of developing these mobile applications, examining each individually.

Prior lessons learned

Grameen's earlier work on Google SMS and early testing of an IVR application in Uganda had equipped us with a lot of understanding about how to develop technology solutions for the poor. This knowledge included skills in effective product development processes and methodologies. For instance, we honed our skills in 'rapid prototyping' – quickly testing very early instances of a product with hundreds of users, incorporating learnings gained from this exercise into the service efficiently, and continuing to develop the product with users directly in an iterative process of testing and application modification. The Uganda experience also provided us with a good comprehension of user needs and preferences in sub-Saharan Africa; we had already made mistakes which had questioned and tested certain assumptions, so we did not need to make those same mistakes again. For example:

- We knew that SMS is not the optimal channel for reaching the poor (we had found that even among those who were literate in English or local languages, the depth of comprehension of a message was far more superficial when information was delivered in text compared with voice).
- We knew that rural clients in particular struggle to navigate an IVR system even when directions are provided in local languages.
- We knew that mobile use is of a fluidity which precludes using phone number as an identifier (users have multiple SIMs and different phones are used when batteries are down which is a frequent occurrence when power sources are scarce).
- We had tried and failed to charge rural poor users a nominal fee for information services.
- We had learned that in many African cultures, people go by several different names which are sufficiently interchangeable and have enough accepted alternative spellings that we would need to enable broad search algorithms when trying to locate clients in a database.

Some validation testing was needed to confirm that these factors were applicable in Ghana as they were in Uganda (for the most part they were), but overall our prior experience enabled us to start our product designs at a later stage of maturity.

A key lesson learned in this process of transferring skills and knowledge between countries and projects was simply realizing the importance of capitalizing on these prior experiences. Beyond circulating the human capital that has gained this experience, how can an organization ensure to document and systematize learnings in such a way that they are retained and are useful to subsequent innovations while still enabling the agility and perspicacity in *new* challenges that is needed for success? This is an element on which we as an organization continue to work, through honest and frank documentation of challenges as well as successes, and through open communication of these across our own projects and externally – being as open source with our ideas and experiences as we intend to be with our code.

Despite the ‘head start’ that our prior experiences lent us, MOTECH is focused on a narrower domain than our previous work; it introduced us to a new end-user, the healthcare worker, and it took us deeper down the paths of using voice and mobile forms as channels for disseminating and collecting information, respectively. Therein lay plenty of new discoveries for us, some of which we will share here.

‘Mobile Midwife’: Application for pregnant women and their families

Assumptions

The number of mobile phone subscriptions is increasing rapidly worldwide (ITU, 2009), particularly among low- and middle-income groups, including those in Ghana (AudienceScapes, 2009). Grameen’s work in mobile applications begins with a desire to use this ever-expanding network of mobile phones as a platform for dissemination of information to those who currently have least access to it, the poor, with the intention that this information might enable them to improve their livelihoods.

As limited as information access may be particularly in rural areas, there have been various important and valuable efforts in social and behavior change communication (BCC) in these areas: informative posters, community radio, theater, infomercials, peer education, advocacy, and use of key community informants are just some of the methods that have been useful in conveying health information at the community level. We started the project with the belief that the communication of this information through mobile would introduce depths of both personalization and share-ability that cannot be achieved through these other mediums.

- *Share-ability*: In testing we found that users liked being able to access their messages at any time and being able to play them as many times as they liked, allowing them to share messages with friends and relatives.
- *Personalization*: Health information which is tailored to the individual receiving it – their stage in pregnancy, care history, location, local value system, and preferences for *when* and *where* they access advice – is a level of information tailoring and ease of access that has not been available in these communities to date. When we look to the likes of Amazon, Google advertising, and Facebook, it seems that their successes partially lie in how intrinsically well they know their clients and how information is tailored so specifically to them. Applying this to the health domain requires confidentiality and sensitivity of a different league, but we believe that the principle remains the same – offering information which is personally relevant to the client is likely to make them listen up. Doing this requires building technology which can support it: a message engine which determines how many weeks pregnant someone is, what care they are (over)due for, what region they are from, which language they speak, and aligning this and other metadata in order to select the appropriate message to be sent. This is challenging, but just the beginning. Having determined what we believed to be the appropriate technology, we then needed to test our assumptions with real users.

Early research and product testing

We conducted a Mobile Health ethnography to assess the state of information, communication, and mobile phone use for maternal and newborn health within both the health sector and the general population (Mechael, 2009). This showed us that there was significant demand for maternal health information among the general population and readiness from these groups to receive such information through the mobile phone. The report also highlighted practices which lead to maternal and neonatal morbidity and mortality, some of which could potentially be ameliorated through information delivered through a mobile phone. For instance, the ethnography identified delay in receiving care and low uptake of services as a contributor to poor health, which could be countered through education in problem recognition, explanation of the benefits of seeking health services, and reminders to attend the health facility for certain care appointments. The ethnography also highlighted the extent to which local myths and traditions can negatively affect the health of an expectant mother and also dictate care seeking practices during pregnancy. This report, therefore, gave us some ideas about the types of content

that would be useful and also the kinds of challenges we should expect. We were particularly nervous about the effect that strong local traditions could have on the uptake of any mobile services we might develop, and the extent to which people might trust information delivered through such a medium; could information delivered through an intensely modern medium be trusted enough to call into question myths and traditions that have existed for centuries?

With this background, we then sketched out a product idea: a service which sends information to women each week of their pregnancy, including appointment reminders tailored to their personal care history. We wanted to quickly test out if this would be of interest to our target audience, if they would find information delivered through the mobile phone trustworthy and accessible and if users would prefer information through SMS or voice. To do this, we set up a basic hotline, with qualified health professionals manning lines between 9 a.m. and 5 p.m. on the days of field testing. Three field teams went out on each day to broadcast awareness of the service, assess user satisfaction with responses, and profile potential users.

- Two-hundred and thirty-six queries from over 220 participants were received in three days.
- The demand for information and level of interest in the service were far greater than expected and overstretched the capacity of the three operators to answer calls quickly enough. The participants wrote down the hotline number and tried to call through the night, although opening hours were clearly communicated. Some participants were willing to spend their own units on making calls to the hotline. News of the hotline spread so that calls were received from communities outside of the prototyping area. On the whole, we saw huge demand for health information and saw that the participants were delighted to receive this information and seemed comfortable obtaining it through a mobile phone.
- One single query was received through SMS, indicating to us the importance of providing information through voice.
- We were surprised that almost 20 percent of those calling for information were men, who seemed to like the private and confidential aspect of the mobile medium. This made us realize a potential to target information to men as well as pregnant women.
- Although we advertised the service as a pregnancy hotline, 62 per cent of queries were related to child health. This encouraged us to consider extending an information service through the child's first year.

- The exercise taught us some valuable lessons about the operational aspects of delivering content through mobile. Many calls dropped mid-conversation in poor network areas and especially during rain storms, teaching us that we needed to build a service which enabled people to call back into retrieve their messages.
- The sheer volume of questions received taught us a lot about people's knowledge gaps, guiding us in the right direction for content development.

Getting the content right

One of our content partners, BabyCenter, a trusted source of online pregnancy information for millions of people around the world, says one of the keys to really good content is getting it 'remarkably right'; knowing exactly what someone is going through at just the right time and offering clear advice for how to deal with it.

Creating content that we were confident was 'remarkably right', actionable, simple, localized, and medically sound took many rounds of consultations with potential end-users, health practitioners, policymakers, and local and global development partners.

We started by asking some pregnant women and their husbands to keep diaries; we provided them with voice recorders into which they were encouraged to record their thoughts, experiences, challenges, and questions related to pregnancy. Through this, we learned how many people are influential in a single pregnancy: mothers-in-law, grandmothers, husbands, and even landlords are significant in decision making during a woman's pregnancy in the Upper East Region of Ghana, with the opinions of pregnant woman herself often being relegated. Perhaps influenced by Western models of pregnancy being a deeply personal experience for a couple, this aspect was a new learning for us as an organization. We realized that we needed to target a broader range of actors as recipients of 'Mobile Midwife' and the information it delivers. We needed to understand the experiences of the pregnant woman in order to reinforce her voice in the household, and provide actionable advice that was targeted not only to the pregnant woman and her husband, but also to others in the family. We initially thought of having different information channels for different actors, but realized that a single phone is usually shared among the household, so this would not really work. We then realized that the way that phones are shared might therefore be an advantage since the health message might be heard by any actor depending on who had the phone at the time at which it was sent. Since the person who hears the message is likely to be one of the actors with influence on the pregnancy, the information, if sufficiently broad, would also be of relevance to them and could therefore also benefit the pregnancy.

Through the pregnancy diaries, we also found that pregnant women in particular expressed a huge demand for information, but also for advice, encouragement, and reassurance. This made us see the product we were developing in a different light – we were not developing a catalogue of facts but rather a friend or auntie to whom people could turn for trusted advice. We believed that enabling the service to take on this role would make people have more trust in the more factual content provided.

Next we held focus groups with other actors who are influential during pregnancy, exploring their beliefs, knowledge gaps, attitudes toward a pregnancy including their fears, challenges, and joys. These focus groups enabled to develop content which could talk to the information needs of each group. For instance, we learned that where women felt that men prevented them from seeking healthcare because they did not appreciate the medical need for it, most men actually explained that they did not have enough money to enable their wives to go to the facility and were worried about that because they realized the importance of such visits medically. This was reported to be a common source of household tension. Having knowledge of subtle dynamics such as this enabled us to create messages which acknowledged constraints and tried to provide tips on how to overcome them (for instance, explaining that healthcare for pregnant women is free; many men were not aware of this).

From these focus groups, we realized that we would not only need to translate content into different Ghanaian languages, but also need to localize *content* for different cultures within the country, since traditional beliefs, myths, and cultural practices in particular are highly variable between regions. We are now determining scalable ways of localizing through identifying a core curriculum of content which remains the same between regions into which localized content is inserted at predetermined points, and developing light and efficient mechanisms for gathering localization information for each area of the country.

Finally, lengthy consultation with health practitioners, policymakers, and local and global development partners ensured that information provided was in line with Ghana Health Service priorities and care protocols.

Once we developed our content, the process of translating and recording it brought out some interesting lessons. We knew from Uganda and our own experiences as users that for voice applications the sound of the voice is important. Therefore, we tested different voices with many potential users. Surprisingly, we found that women were quite open to receiving information from a male voice for certain topics such as those about savings and finances, support that pregnant women might need during pregnancy, and some childcare messages. Indeed, many said they were happy about that since their husbands might be encouraged to become equally

knowledgeable and supportive as the man reading the message. We also found that, consistent with people seeing the service as a source of reassurance and advice, people wanted to hear an older, soft voice, like a trusted, experienced and sympathetic ‘auntie’ (a term used in Ghana to show respect toward elders). Once we had found actors who spoke the appropriate languages, there was concern from users about the ‘depth’ of their accent. Consistent with research on source credibility, users disliked voices with accents from ‘deep in the village’ as they were not trusted as being knowledgeable enough (Erickson, Lind, Johnson, and O’Barr, 1978; Sternthal, Dholakia and Leavitt, 1978; Heesacker, Petty and Cacioppo, 1983; Pornpitakpan, 2004). Equally voices who sounded too educated were not accepted, as they were not seen as being from a place that would enable them to fully understand the daily struggles of life in the users’ area.

Messages were diligently translated and back translated, and we even spent time finding symbols in the word processor which were needed to express the local languages in written form. However, when it came to recording these we were not able to find anyone – across all levels of education – who could read the translations, except for professional translators, and local language linguistics experts. With hindsight it makes perfect sense: these are oral languages whose written forms have not been extensively developed. After weeks dedicated to obtaining the perfect written translations, we had to abandon the written local language scripts and resort to impromptu translations from the English text by the voice actors themselves, in consultation with a qualified health worker fluent in the language.

Mobile access

Mobile phone ownership in Ghana is estimated to be around 32 per cent, with 72 per cent of people estimated to have access through someone in their household (AudienceScapes, 2009). Even for those who own a phone, SIMs are frequently changed if a stronger signal can be received with one network over the other, so there is often not one single phone number on which someone can be reached. Therefore, we designed the system to enable calls and SMSs to be pushed out to those who had reliable access to a phone, but which also enabled all subscribers to call in to access their messages. Relying on women calling in to retrieve their messages, however, has resulted in lower uptake of the messages overall. Since IVR systems are not often used in Ghana, some women find navigating them challenging, even with directions provided in local languages, so this may be a barrier to uptake of this option. Even if a household owns a phone, it may be switched off frequently as charging phones is challenging in rural areas. Therefore, we designed the system to keep attempting to call a phone until it is turned on. Interestingly, when registering clients, we found that many who had a phone in their household did not know the

phone number from memory. Therefore, when organizing registration days and in marketing collateral we asked people to make sure to bring their phone number (if they had one) with them written down for registration.

Personal identifiers

The issue of how to uniquely identify clients was challenging to resolve. There is no comprehensively executed national ID system currently in place in Ghana and no universally implemented identifiers used in the health system. However, for Mobile Midwife we needed an identifier or combination of identifiers that could be easily remembered or located by the patient, and easily entered onto a phone keypad and processed by an IVR-type system to identify the patient uniquely when they call in to retrieve messages. We considered using phone number as a way to identify clients calling in to MOTECH, but realized that this would not work owing to the high turnover of different SIM cards and the widespread practice of sharing phones meaning that more than one MOTECH client may be relying on a single SIM.

After some investigation, we realized that developing an ID scheme for MOTECH would be necessary for accurate data and ease of access. Therefore, all clients registered in the system are issued a nine-digit numeric code at registration, which takes place at a health facility or by calling a toll free call center. We selected a numeric code to enable easy input using a phone keypad. The client is provided with this number on an ID card which is issued at registration, or over the phone for call center registrations. This ID number is also noted by health workers next to the client's record in their registers. The ID number is used from then on by both the nurse and the client. When nurses enter information about a particular patient into the MOTECH system, they use the patient's ID number. When a patient calls in to MOTECH to retrieve their messages, they are first requested to select their language, and then they are asked, in their selected language, to enter their MOTECH ID number. Entering the ID number tells the system who the client is, enabling their personalized message to be played.

Another challenge was designing a methodology for identifying duplicate registrations in the MOTECH database, or uniquely identifying patients in the case that their MOTECH ID has been lost. Using simple demographic fields such as name and date of birth seemed unreliable since our clients often go by several different names and are not so concerned with accurate spelling of them. Also, many people in rural areas do not know their date of birth. The only solution to this issue has been to rely on a triangulation of fields to try to identify patients: a broad search is enabled when trying to locate a patient in the database by name, and a combination of address, date of birth (where possible), National Insurance Number (where possible), and relation to other family members (for example children) in the

database are all relied upon for unique identification. This system has worked quite well, although it has not been able to eliminate the instances of duplicate records altogether; manual review is still required to identify some cases.

Accidental learning

The intended design for the system was that a user who wants to retrieve their messages by calling MOTECHE would call a toll free, universal short code which would connect them with our IVR system. We were not able to set up this toll free, universal code in time for launch so as an interim solution we had to connect through a normal phone number which charges at peer-to-peer rates. In order to be able to offer this service free of charge to our users under this set up, we designed the system to respond to a ‘flash’² from a client (Donner, 2009). ‘Flashing’ prompts the system to call the user back, placing them in the IVR home menu. Although we intended this to be a temporary solution, from initial focus groups with users it seems that they really like being able to flash the system. Flashing is a widely used mode of communication in Ghana, so people are familiar with it. Most of all, users like that with flashing they can be sure that they will not be charged for the call.

MOTECHE nurse application

Nurses in rural clinics in Ghana currently rely on a substantial number of patient registers for data collection, sometimes up to thirty different registers can be used in one facility. Some are provided by the Ghana Health Service, others are simple exercise books formatted by nurses themselves. Different registers are used for different care types (for example outpatients, antenatal care, postnatal care, delivery, and child welfare). There are challenges with this mode of data collection.

Firstly, it is difficult to link different types of care for an individual patient to see their care history. For example, you cannot see from the antenatal register which sicknesses a woman has suffered from during her pregnancy.

Secondly, nurses have to spend a lot of time (four to six days per month) aggregating data in the registers to complete reports that they are required to send monthly to the district offices, and which are subsequently aggregated for the district and region. Not only is this process extremely time consuming for nurses, but its manual nature also makes it very error prone, reducing the usefulness of the data for decision-making, monitoring, and reviewing performance.

Thirdly, although the nurse spends a lot of time extracting information from the registers to send to managers further up the system, very little useful information flows back to the nurse. For instance, it is extremely difficult, using the registers, to identify clients who have defaulted for care or who are high risk for certain illnesses.

It seems clear that transaction-level electronic recordkeeping would combat many of these challenges. Some projects and research have attempted to address this challenge by providing facilities with laptops (Fontelo, Liu, Zhang, Ackerman, and Tolentino, 2008) (Partners in Health, EngenderHealth, Better Health Outcomes through Mentoring and Assessment), or smartphones (Open Data Kit, eMOCHA, Sene Project) for data dissemination, capture, and submission for healthcare providers. While such initiatives undoubtedly add value, we wanted to try a solution using lower-end technology which would be more manageable for government entities to support in terms of training, power, and hardware costs.

Selecting handsets and mode of data transmission

We set out with a goal to rely on nurses' existing phones. A poll of over 100 nurses' phones in the Upper East Region showed that only around 15 per cent of them had Java-enabled phones, making reliance on nurses' phones synonymous with reliance on an SMS or voice solution for data transmission. Therefore, we trialed an SMS-based system, which revealed a number of challenges:

- Older nurses in particular did not know how to send or retrieve SMS, so induction had to include basic SMS lessons in addition to data entry training.
- Even those nurses proficient with SMS struggled to follow the strict syntax required to compile a structured SMS – typos, missing spaces, and incorrect data order made data capture difficult. We tried to overcome this by saving SMS templates containing field titles on to the phone as SMS drafts. This did not work in many instances, since the low memory capacity of many of the phones put a limit on the number of SMSs that could be saved as drafts, and yet there were around ten different SMS types that were required for our purposes.
- Some phones did not have a drafts folder. In these cases, we saved the messages in the inbox, but again here we were met with the challenge of low SMS storage capacity.
- We also found that nurses accidentally edited the SMS templates, meaning that subsequent submissions were flawed.
- Some phones were not able to send SMS because Message Center settings were incorrect.

Providing training to overcome these challenges was extremely challenging when supporting the many different handset types owned by nurses.

In addition to these data challenges, there were several social aspects which made using nurses' own phones impossible. Phone access and ownership seemed to be as fluid among nurses as it was among people in the community. Many nurses shared phones with family members, so there would be times when no phone was available in the clinic, and the fact that phones were lent to non-Ghana Health Service staff posed a privacy risk for patient data. Lack of charging solutions was also an issue, as not all facilities had reliable power. Finding a charging solution for the many different phone types that nurses were using would have proven challenging. Furthermore, nurses were unsatisfied with using personal phones for professional purposes; they felt that if they were required to do something for their work, their employers should provide the equipment deemed necessary to do it.

The reasons for our hesitance to provide dedicated MOTech handsets to health facilities were in part financial; using nurses' own phones and relying on SMS would eliminate the upfront cost of hardware provision, thus making the project more accessible to and sustainable for government agencies in resource-limited settings. The SMS versus data issue has been much debated (Donner, 2009). For us, the pivotal point came when we did some calculations around data transmission costs where we found that investing in phones which can transfer information using GPRS actually reduces the total cost of ownership of MOTech. GPRS data transmission is many times cheaper than SMS. A MOTech form that requires one to two SMS messages can be transferred in less than 1KB of data, resulting in savings of approximately US \$11 per health facility per month³. The cost of the dedicated GPRS phone is offset by the savings in data expenditures in just over five months, making the financial sustainability of the project more feasible. Crucially, investing in dedicated MOTech phones also eliminated our reliance on SMS since Java-enabled phones could be purchased at a low cost. Even low-end Java phones unlocked for us a potential that could not be realized with SMS:

- Firstly, Java-enabled handsets are more suited to poor network areas than SMS because forms can easily be saved on the phone and uploaded when connectivity is restored. We had found network reliability to be a challenge in the rural areas in which we were working, so this was an extremely useful feature.
- Secondly, security features such as user authentication schemes can be built into Java forms, but are not possible with SMS. This is an important aspect of a system that is transferring sensitive patient information.

- Thirdly, leveraging Java-enabled phones from the outset of the program better facilitates the development of more sophisticated applications, without needing to re-train users, re-distribute hardware and softcopy documentation, or change platforms. Therefore, we felt that Java-enabled phones provided a stronger foundation for developing applications, providing more potential for supporting effective service delivery.

We selected the Nokia 1680 for our pilot because it was low cost, had a long battery life, was durable, and 80 per cent of the nurses owned Nokia phones of their own, so we expected them to be more familiar with how to use them than phones from other manufacturers. We issued phones to facilities with an equipment agreement that was developed together with the Ghana Health Service. The agreement indicated that MOTECH handsets should remain in the clinic or any other place of service delivery at all times. It included a penalty for nurses in the case that a phone was lost or stolen owing to negligence. Levying a penalty for a lost or stolen phone is at the discretion of the district director. Therefore, if she or he decides that the phone was lost or stolen not owing to any negligence on the part of the nurse, she or he can decide not to enforce the penalty. We ensured that the penalty was low enough and left enough room for discretion that it would not deter nurses from using the phones. Should the penalty be imposed, it is shared by all the nurses at a facility, with the majority being paid by the nurse who lost the phone. This shared responsibility model was created in order to encourage nurses to accept joint responsibility for the handsets and to support each other in keeping it safe.

Nurse incentivization

We found in situ testing to be extremely important for maximizing the quality of the feedback for system design. We held several workshops in which nurses tried out applications in role play. These were useful for highlighting issues with navigating the application or training challenges, but had limited value for inviting discussion on which additional features would be most useful, how the application would alter or integrate with existing workflow or potential benefits and annoyances of the application in the nurses' daily routine. Therefore, we also requested nurses to use the prototype of the application with real patients in their facilities for one month, as if the service were already live. This enabled nurses to really experience the effect of the application on their work, to the extent that they were able to suggest improvements and new features that they believed would help them. This was invaluable for enabling us to modify existing parts of the application and even spec out new features in direct response to the suggestions of the nurses.

In this prototyping stage, nurses identified that they thought the application would result in time savings and better information flow. They anticipated that time savings would come from the automation of monthly reports. In the design of the system, this was intended to be the main incentive for nurses to enter data into MOTTECH. However, when MOTTECH was actually implemented, we found that initially nurses did not recognize automated reports as an incentive. In the field, nurses were requesting us to buy lunch for them in return for the extra work MOTTECH was making them do, and some even asked for money. We think that this originated from two aspects of how the project was implemented.

- Firstly, the benefits of automated reporting cannot be realized until data is submitted for every single client seen in a month. Unless all data is entered, reports are inaccurate, so nurses are required to add in the data for those clients whose information was not submitted to MOTTECH. Therefore, in the ramp-up stage of the project when nurses are becoming used to the application, reports are unlikely to be complete meaning that nurses do not save time on reporting at all. We tried calling nurses to encourage them to enter all forms, and monitored their daily uploads so that we could prompt them when no data had been sent. We set up competitions in which the most active facilities would receive small gifts such as radios. These encouragement methods seemed to be quite effective, and we are seeing successful use of MOTTECH in the facilities, with nurses now realizing its benefits. We were surprised by how constant this encouragement needs to be (literally daily), and how time-intensive it is to support this. We have come to realize how using new technology in these setting is a really significant shift in work practices and culture, and so its integration will take time.
- Secondly, MOTTECH was seen as a discrete new ‘project’ by nurses. Instead of seeing MOTTECH as an element of their normal responsibilities as Ghana Health Service employees, nurses regarded it as something extra brought to them by an external organization that would one day go away. We think this was because the project timescales meant that we were required to work in facilities testing applications with nurses at the same time as developing the higher level relationship with the Ghana Health Service. Therefore our first interactions with nurses were when the relationship with the Ghana Health Service was in its nascent stages; they could see this and so the project appeared to be coming from an external entity. Therefore, we worked more closely with the Ghana Health Service so that their staff was more *visibly* active in the project and a Technical Working Group was set up to ensure closer liaison

between MOTECH staff and Ghana Health Service staff to ensure seamless coordination in the field, aspects of collaboration which would ideally have been in place from the beginning. These steps improved the nurses' perception of the level of Ghana Health Service ownership of MOTECH, which in turn improved the consistency with which they submitted data, better enabling them to see the benefits of automated reporting.

Community volunteer incentivization

The Ghana Health Service has a system through which each community has health volunteers who are responsible for liaising between health facilities and community members. As part of their Ghana Health Service responsibilities, these volunteers have also become ambassadors for MOTECH. They are tasked with assisting new clients to register into the system, helping existing clients to access their messages and reporting recent unattended child births into the system. When the project was launched, these volunteers were invited for training and issued with T-shirts and promotional flyers and posters. We had heard other projects say that the community status gained from working with projects was a sufficient incentivization to keep volunteers involved. We have found this assertion to be overrated and have found that volunteers seek an opportunity for income generation or rewards such as bikes, radios, and phones. We will soon, therefore, we are currently considering a reward scheme in which airtime units are issued to volunteers per interaction with MOTECH.

Partnerships

Government

Technology organizations typically have a flat organizational structure in which there are few levels between staff and managers, employees of all levels are involved in decision-making processes and there is free communication between junior and senior staff. It follows, then, that Grameen Technology Center follows a similar ethos. Adjusting this working culture for a more hierarchical government structure took time and discipline. Communicating appropriately with government proved critical to the success of our important partnership with the Ghana Health Service. Some learnings in this area include:

- Government needs to be engaged as an equal partner in design, implementation, and oversight, including managing the challenges.
- It is important to follow proper protocol and demonstrate respect for government institutions, culture, and expectations.

- The project needs to directly support national priorities.
- For success the project needs rational endorsement, approval, and leadership from within the government entity.
- The project needs an understanding of the role of national, regional, and district level government and how to engage with them.
- Projects should recognize the need to provide extra functional support to facility the involvement of government at different levels.
- Projects should be aware of different partner organizations working in the same area, to avoid being a coordination burden for the government entity.

Academic institutions

Columbia University is undertaking a social impact assessment of the MOTTECH pilot implementation in the Upper East Region in order to determine the impact of the mobile intervention. The challenge with how this and many other grants are set up is that there is very limited time to design and build applications, implement, and prove impact; for MOTTECH all this had to be achieved in two years. The difficulty here is that introducing mobile technology to a well-established paper-based manual system introduces a substantial shift and requires workers to adapt long-standing working practices in order to accommodate the intervention. It takes a lot of time, therefore, for the system to stabilize – both technically and operationally – to a point at which it could be considered to be operating smoothly enough for an impact assessment to be conducted. We have had to continuously re-prioritize technical and operational tasks to ensure the rigor of the social impact assessment, and our colleagues at Columbia University have also had to be ready to alter research plans to allow for suitable stabilization of the system. Another challenge with research in short grants is that social impact results, which would make donor proposals more compelling, are not available until after the initial funding ends.

While there is much emphasis on achieving social impact, there are many formative learnings that have a lot of value to the project and potential future implementations; we believe that these should not be overlooked. We have found it to be useful to take some time every few months to think reflexively through what has been learned, what mistakes we would avoid in the future, and which successes we would like to carry forward. Many such learnings and decision points have been explained here, and more can be found in ‘MOTTECH Ghana: Lessons Learned So Far’, available online. We intend that noting these aspects will assist future iterations of the project and will enable other implementers to see the logic behind some of the decisions made.

Telecommunications operators

Establishing infrastructure to enable our software systems to interact with mobile network operators was a much more time-consuming process than we anticipated, an experience shared by other development projects and private sector. Acquiring a short code that could be used across multiple network operators – a valuable revenue generator for telecommunications companies – took twelve months. Installing and configuring E1 lines to connect with all the telecommunications networks took even longer. Projects should get a very early start on building their communication systems with network operators.

Conclusions

MOTECH has taught us much about how to develop applications not only for end-users, but also in organizational settings. As has been explored here, there are common themes to designing applications for these users, as well as some differences. Some of these are explained here:

Table 8.1 Some common themes when designing mobile applications for end-users and organizational settings

Designing for End-Users	Designing for Clinic/Organizational Settings
User-recognized lack of information drives demand for service which is seen as something with potential for personal benefit (being more informed, having better health). This makes the marketing message quite straightforward.	Demand for service comes from organization, which does not always translate into recognition of need for technology intervention by individuals (nurses). Seeing the personal benefit is to some extent dependent on personal satisfaction derived from doing a thorough job, so is not universally present. This presents a challenge to uptake and compliance, and can limit the success of efforts to encourage that.
Necessary to use a technology familiar to the user to enable uptake.	Possible to introduce new technologies owing to greater capacity to train staff.
Intervention works because it slots into the everyday routines of the user. Users typically already use phones, already receive and make calls, etc.	Potential benefit of the intervention lies partly in its change of a process of workflow. This also makes it more difficult to integrate the service into the routines of the health worker than for end-users.

Designing for End-Users	Designing for Clinic/Organizational Settings
No apparent business model which makes provision of mobile phones a viable option, forcing dependency on common channels – voice and SMS.	Total cost of ownership is reduced by providing phones to nurses, enabling use of data and more sophisticated apps.
Credibility through association with respected partners is important for people to trust the information.	Credibility is gained only through demonstrating Ghana Health Service ownership of the intervention.
Critical that intervention is not seen as a standalone effort but one that complements other parallel behavior change initiatives.	Critical that intervention is situated in an existing ecosystem. For instance, phones cannot have an impact unless they are implemented alongside efforts to improve service delivery.

Notes

- 1 This chapter is a distillation of some of the main themes explored in Grameen Foundation's self-published document 'MOTECHE Early Lessons Learned', available at <http://www.grameenfoundation.org/sites/default/files/MOTECHE-Early-Lessons-Learned-March-2011-FINAL.pdf>. While the self-published document is a summary of main learning outcomes and actions taken, this chapter explores in more detail and in a more discursive manner, the processes and methods used in developing the applications with particular attention to client and nurse behavior change. Grameen Foundation permits the release of this shorter document and its inclusion in this publication.
- 2 In Ghana, the term 'flashing' refers to the act of giving someone a missed call: calling a number for a few seconds and hanging up before the recipient has time to answer. Some studies estimate that flashes make up 20 per cent to 30 per cent of all calls made in Africa.
- 3 An SMS on MTN, Ghana's leading mobile carrier, costs 0.045 GHS per message. 1 kb of GPRS data costs 0.000195 per kb. On average, CHPS compounds in the KND district send 360 messages per month, based on 2009 DHIMS reports.

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