

# Mobile M&E: Experiences from Pilot to National Scale Implementation

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**Abstract:** Implementation of Monitoring and Evaluation (M&E) programmes are predominantly dependant on paper forms to measure organisational impact. These forms are then manually captured into an electronic system for analysis. This methodology results in high costs, questionable data accuracy and long turnaround times. Additionally inadequately skilled employees, remote locations and high staff turnover add to these challenges. A solution that allows for flexibility and extendibility within the NGO sector is required to decrease costs and allow for NGO's to focus their attentions on their main areas of expertise. One potential solution is the use of mobile phones to collect the data. This paper presents the experiences of implementing a mobile phone based M&E system and the lessons learnt in scaling this system from pilot to national. These include system flexibility, easy-to-learn interfaces, identification of champions and detailed site assessments. Today the system is being used nationally, with over 70 000 electronic surveys submitted and over 300 facilitators using the system.

**Keywords:** Monitoring and Evaluation, M&E, mobile phones, open source, HIV, NGO.

## 1. Introduction

The South African Non-Government Organisation (NGO) sector has always played a prominent role in the education of communities on various social development issues. These range from education on HIV/AIDS, awareness on healthy living, counselling and testing to gender equality. NGO's have also had strong ties to communities and in many rural areas have been a structure much appreciated by the community members. In discussions with NGOs it was clear that they all experience similar challenges in their daily operations. High staff turnover, low IT literacy rates, the management and tracking of field workers and the growing demand for proper governance and reporting by donors has resulted in organizations having considerable pressure in producing accurate reports that can be auditable, adequately trained staff, traceable form submissions and consistency in organisational processes. Another challenge was producing accurate data that measured how well facilitators service the surrounding areas and benchmarking this data.

A method many organisations used to monitor their impact is through paper-based questionnaires. These questionnaires are completed by field workers. This paper form would then be verified for authenticity (usually on site) and returned to the head office for further capturing and analysis. Only after these forms have been captured into an electronic spreadsheet, could the data be analysed for reporting purposes. The problem with this method was that it meant long turnaround time from initial field work to the reporting of that data and decision making based on this data was thus delayed. There was also no real way of knowing if the information captured was accurate and verified. This proved to be

very challenging for managers who would often find duplicate paper forms, forms that have been lost or destroyed as well as inconsistent data. Additionally, there were high expenses incurred for the printing of questionnaires as well as transport costs. It was clear that there was a need to eliminate high paper and ink costs, improve turnaround times from initial capture to reporting and increase data accuracy.

The challenges that many organizations were facing required a solution that was both easy to use, flexible and didn't require in-depth training and knowledge. This solution would also need buy-in from facilitators and be something they would find familiar. One such solution was the mobile phone. According to World Wide Worx [1], a leading technology research and strategy organization, there are over 30 million active cell phone accounts in South Africa with penetration close to 90%. These statistics suggest that mobile phone technology is perfect for not only bridging the digital divide but also provides an opportunity for NGO's to use this technology in capturing data.

It was this discovery that inspired EMIT, a mobile data capture application that could be used by NGO's to facilitate their data capture process. Instead of using paper forms, field workers of NGO's could now use their own handsets to capture their work activities. The goal of this tool was real-time data submissions that increased accuracy and decreased costs. The EMIT application was also to be flexible in that it could work on any Java enabled handset making it extendable as well as easy to deploy to handsets. Another goal was that the application should be standardised and able to work on all most handsets whether cheap or expensive. The fact that the application can work on cheap handsets could result in a smoother transition as the facilitators won't feel intimidated by having an expensive handset trusted to them.

In this paper we will describe the EMIT mobile data application, how it works, the benefits it has brought to organisations and our experiences in taking this application from a pilot to a national scale implementation.

## **2. System Description**

The EMIT mobile data collection system is an application that allows field workers to capture data on their mobile handset and submit it to a centralised database. The electronic survey itself is tailored to the NGO's current paper forms and business rules which ensure data accuracy for the manager when reporting on the submitted data is required. This application is deployed to handsets where it is saved and the facilitator can login to the application after every session is complete.

Once the application is ready for use and all components have been tested it can now be deployed and loaded to various handsets. If this is the first time the field worker is using the electronic form, they are sent an SMS containing a link to download the emit application. Once the application is successfully loaded onto the handset the field worker can now collect field data using their handsets. When they have successfully completed the electronic survey, it gets sent via GPRS to an EMIT database where managers can in real-time monitor data collected by their field workers. Managers can now extract a complete dataset of all submitted data and verify completed surveys as well as make corrections to all submitted electronic surveys. Once the manager has verified the submitted data an aggregated donor report can be generated according to the funder's requirements.

The EMIT mobile data capture application is developed using the Java Mobile Edition programming language for handheld devices (also known as J2ME). A key feature of EMIT is that it allows completed forms to be saved on the handset. Thus should a field worker have insufficient airtime or is in a location with limited signal the form can be saved and resent at a later stage. The forms are sent via GPRS which is substantially cheaper than the commonly used Short Message Service (SMS) technology [2][3]. This fee can range between two to four South African cents per form depending on the quantity of questions in

the electronic survey. This cost is significantly cheaper than printing paper and allows for faster turnaround time and increased data accuracy.

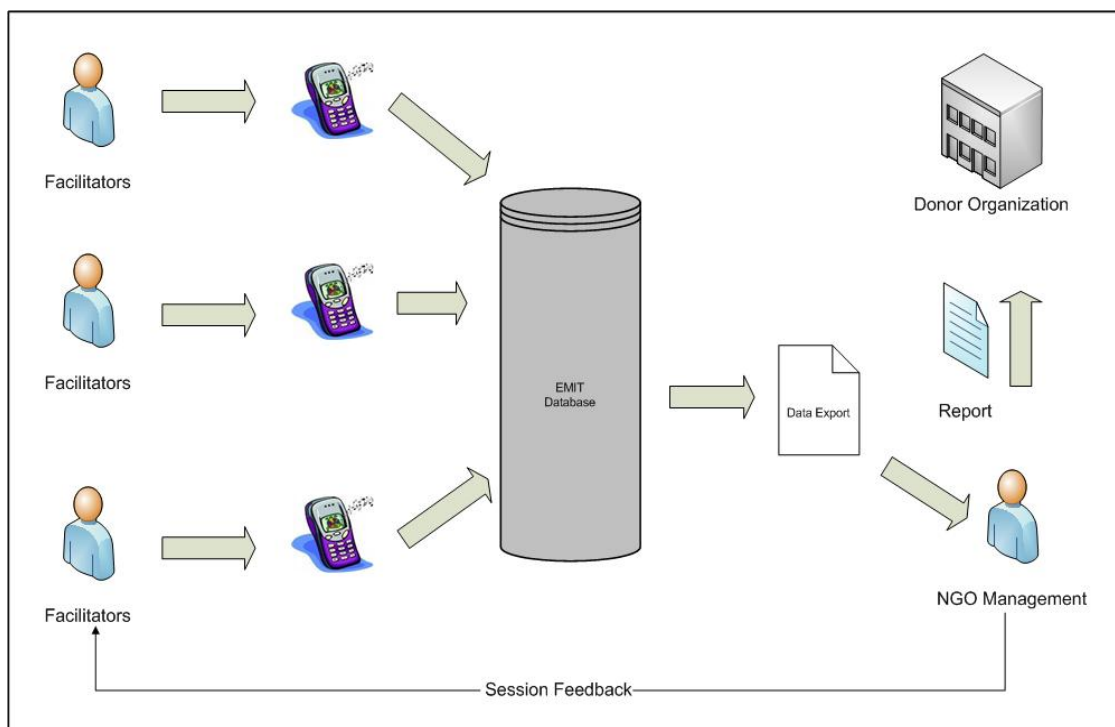


Figure 1: EMIT Mobile Data Capture System

The EMIT system places key emphasis on data accuracy and integrity. Managers based at the NGO should be able to look at data from multiple views and extract information relevant to them. This functionality proved to be useful to managers as they could now extract key findings, outliers and general trends from the real-time data. Besides the normal process of extracting data and using it to report efforts and reach to donors they also used the data to track and manage the productivity of fieldworkers on the ground. This was done by managers being able to run various fieldworker reports that give an indication of how often the fieldworker completed a form, if the data was consistent and verified, as well as the geographical reach and effectiveness of sessions conducted by the field worker.

EMIT was built using existing Open Source tools namely JavaRosa and Limesurvey. Javarosa is an Open Source platform for mobile data collection and is based on the W3C standard for next-generation data collection and interchange. This platform is currently used in various African countries and has added similar value to NGO's. Limesurvey is an open source survey application that allows users to create surveys, view and collect responses to surveys. This software has been customised and configured to organisations that require tailored solutions. Limesurvey has allowed EMIT to rollout much faster to organisations due to its flexibility and robust design.

### 3. Pilot Implementation

The pilot of the system was performed with the Community Media Trust (CMT), an NGO based in Cape Town, South Africa. It consisted of seven CMT facilitators who were given handsets for use in the field to gather data from clinics, schools and other community initiatives. Because this was a relatively new system, it was a controlled environment with strict emphasis placed on monitoring the impact of the tool in terms of usability costs, time savings as well as accuracy of a fieldworker's data collection.

Costs were measured through airtime usage for report submissions. Time was measured by benchmarking the time taken from an event occurring in the field, to its reporting being available electronically for management. Accuracy was measured by taking the frequency of errors in data on the paper forms and comparing it with the new system. These metrics were monitored throughout the pilot.

Once the handset with the application was deployed to the facilitator it was reviewed on a monthly basis. This review was conducted in feedback sessions where field workers discussed their experiences of using the tool in practice. The outcomes of these sessions would then result in updates to the system and tailoring of the process to the needs of the organisation. After the third month of usage a detailed comparison was conducted between the current system and the old paper driven process. The results found that in the three months of EMIT usage, costs had decreased significantly in printing, courier and data capturing fees to the marginal costs in airtime. Data accuracy had increased because the handheld forms had constraints and mandatory fields so facilitators were unable to submit uncompleted forms. Managers also testified to the fact that they had more time available to manage their staff by seeing the productivity of fieldworkers through their real time submissions. It was these successes that would see CMT extend the system across the organisation, rolling out EMIT to other branches nationally.

#### **4. National Rollout**

The strength of the pilot resulted in more organisations showing an interest in the data capture system. It became apparent that the advantages of saving cost and time whilst increasing data accuracy was a common need to many NGOs. It was at this point that the John Hopkins Health and Education of South Africa (JHHESA), a body that funds NGO's across South Africa, approached Cell-Life to do a national implementation that would see the organisations they manage be added to the M&E system. The decision to do this was because they had grown significantly in size and it was becoming difficult for partners to manage data, verify data and report on this data.

Because of the size of the proposed project, it was decided that a phased implementation would be needed.

The first phase would be getting all partners on the system so they could capture field data and run reports from an electronic spreadsheet generated by the system. The second phase would extend this to include automated reports for partners on their data, as well as a graphical view of all partners for JHHESA. From a series of discussions we found that because of the number of NGOs JHHESA partnered with, the process of collating and analysing each partner report was immensely time consuming. Furthermore the reports they received from their partners were not always submitted timeously and often suffered the data errors experienced in hand written reports. Also the collating of the data had to adhere to complex business rules before being displayed.

Once the technical system was finalised, the various partners across South Africa were trained on the system and were provided with ongoing desktop support. The result was that partner organisations used the technology to gather data, and managers could track the work of fieldworkers and compile accurate reports. JHHESA were also able to run funder specific reports and track organisational impacts by comparing them against their targets.

This project has successfully entered into the second phase and has seen over 300 people in various locations from urban to rural receiving training and have to date, seen over 70 000 forms submitted. Whilst this is testament that scaling systems in M&E is indeed possible, it however required a set of techniques for the project to proceed.

## 5. Lessons Learnt

The degree of control exercised with the pilot project could not be rolled out to the large number of partner organisations. However, it was important to do appropriate requirements analysis with each individual organisation prior to system implementations. A Requirements Specification Document was produced for each partner, highlighting each organisations responsibility, timelines, expected volumes, on-the-ground challenges and risks, as well as an outline of the proposed solution. This document was provided for each organisation and required sign-off from the stakeholders before starting the project. Getting this sign-off aided with buy-in from the partner organisations and ensured they were happy to go ahead with this project.

Open Source Software tools were used to build the majority of the system, and this contributed to its rapid development by reducing initial costs for development. It also provided a base from which additional development could be done, to cater for specific user requirements. In turn, this allowed Cell-life to experience rapid deployment rates and reduced costs by having no yearly licensing fees for the project [4].

When the EMIT system was developed it had to have a degree of flexibility to allow for customizations, but more importantly was the usability of the system. Usability is a term used to identify the ease with which a user interacts with the system [5]. To make sure usability was acceptable to users a User Centred Design methodology [6] was adopted. This approach includes users throughout the design and customization process allowing users to give feedback and suggestions to key elements in the system. This was especially useful when organisations had complex forms and business rules. The User Centred Design also aided in organisations taking more ownership of the application and encouraged much feedback [7].

Another key lesson learnt was identifying champions in an organisation who took ownership of the system [8][9]. Many of the organizations experienced high staff turnovers, at times resulting in cases where the system usage was dormant. This resulted in low submissions and overall decreased morale towards the system. It was only after the organisations were analysed and key players were identified that interactions with the system started to increase. It was found that if two or three key individuals in the beginning stages of a project can be identified that recognized the value in the system, submissions would be higher and would improve buy-in from the rest of the organisation.

Training with the various organisations had to be clear, specific and customised to the individual skill level of the users. Training was conducted by creating real life scenarios where users could log into the system, complete a form and submit data. This form of training proved to be more effective than handing out manuals to users and working from that. There was a degree of hesitance from some fieldworkers who had not yet been exposed computers and software. These isolated cases required more a hands-on detailed training session, with a particular focus on getting the user comfortable with web data capture and computer literate. It was found that although some users may not have been comfortable with using computers all were very familiar with using mobile handsets and navigating on the EMIT application. This confidence showed that users are more inclined to use the mobile data capture as opposed to the web capture largely because they felt less intimidated by handsets. Training was concluded with issuing a system manual and a video tutorial of all that was covered in the training. This video tutorial could now be used by the manager to train any new fieldworkers that needed system training. This was especially useful as managers could train fieldworkers in their own language and terminology which would be more useful to the fieldworker.

A key lesson learnt was that emphasis should not only be placed on fieldworker training in the data capture process but also in managers and other staff, to ensure that they have a



clear understanding of the system and expectations can be managed. It was found that although fieldworkers were using the data capture application, managers weren't as well equipped technologically to understand the submitted data as initially assumed. The approach taken for manager training included data capture, data verification, querying data in a spreadsheet and process walk-throughs. This would leave the manager well equipped and even provide first level support to the fieldworkers on system use. It was also noted that besides the technology aspect which at times proved to be easy there is a more important aspect of people challenges that came up. These challenges such as people being reluctant to change and internal politics had to be managed effectively else it would result in failed project due to issues not related to IT.

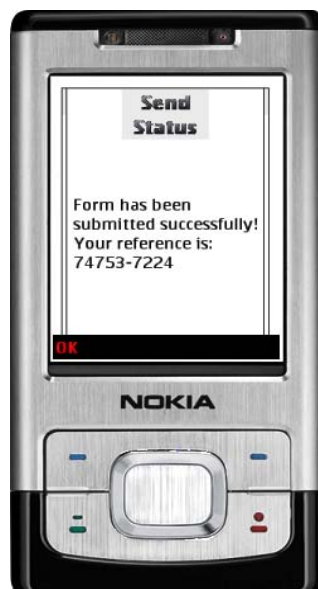
After a few months of usage, the number of submissions received through the EMIT system were significantly lower in certain organisations that was initially forecasted. After investigations with the relevant partners we found they had experienced high staff turnover and many were struggling with organisational issues with little guidance from their funders. Upon further analysis it was found that the staff initially trained was either no longer at the organization or had lost interest due to the ever changing environments. Although the solution itself was relatively simple, it required constant communication with the organisation. To combat issues of low submissions a weekly internal project meeting was instituted with the Project Stakeholders to ascertain the reasons for the change in submissions.

These meetings would analyse submissions of the various organisations over a period of time and identify possible organisations that are struggling. Once an organisation was identified it was the responsibility of the business analyst to fault find and understand why submissions were low. This process of identifying and troubleshooting low submissions proved to work well, as with many times it was a result of organisational issues rather than technological. This also allowed Cell-Life to offer support and advise accordingly. This sparked an even bigger interest in the online system as it was no longer seen as just an initiative by a donor but rather a tool that can help their efforts and identify specific problems in their organisation.

Another interesting lesson learnt was the discovery that a few organisations had ill-defined organisational processes that, making it hard to implement a solution that had little existing foundation. In specific cases like this it was important to analyse existing processes and re-engineer processes that were redundant. This was done by having workshops and interviews with relevant parties to try and come up with a better defined process that could not only be auditable by funders but logical to the M&E manager. This was very successful as it allowed Cell-Life to analyse organisations and customize the technology accordingly.

Another area in which lessons were learned is in the costs associated with the system. The main operational costs for this project are the handset and the airtime costs associated with completing a form. Through Cell-Life's past relations with handset suppliers we will be investigating discounted rates that NGO's get for the purchase of the handsets. Cell-life will also look into managing airtime for a client as many organisations find this task quite arduous. We are investigating pre-loading handsets with data bundles before deploying to a client. Data bundles are specifically useful as it allows the client to assign a specific amount in Rands for browsing the net, completing forms, sending and receiving forms without touching the airtime for voice calls. This will ensure better management of airtime and because data bundles only get charged out on data sent and received, which is a small fraction, will last much longer as opposed to loading airtime that can be used for voice calls, SMS and browsing the internet. The only challenge this presents is that data bundles have an expiration date, meaning that if it is not used in a specified period it can be terminated resulting in a loss. The only solution is to conduct a proper study where usage is forecasted to better ascertain how many bundles should be bought.

Perhaps one of the most important lessons learnt was how organisations get audited by donors. Because many organisations receive funding from donors, these donors often do audits on data collected by the organisations. Depending on the donor organisations auditing policies audits can be done in many ways. One such way was a manual auditing process where original source documents are scrutinized and verified to see if the information recorded on the forms is a true reflection of what happened on the field. The EMIT system at the time had not catered for this, largely because the system was secure and was open to online auditing if it was needed by donors. After consultations with donor organisations it was clear that this functionality should be added to the system as many organisations using EMIT were manually audited. The system was then customised to allow auditors use of the EMIT system to view online data completed by fieldworkers. An added feature was to include a unique reference number that would be generated once a form is completed and successfully sent to the database. This number then appears on the screen and requires the fieldworker to write the number on the original form. When auditing is done, the auditor can view all online data and once a form with irregularities is found the auditor can request that the original document be viewed by quoting the unique reference number attached to the digital copy.



*Fig 2: Reference Number After Online Survey is Completed*

Upon the design of EMIT it became evident that EMIT had huge potential to be replicable across many sectors. This was realized when private institutions expressed an interest in EMIT to do their data collection and analysis. Although EMIT is replicable to many sectors it would however require some customization where specific business rules are to be built into the system. However because EMIT is flexible and offers good usability at a low cost it makes this application a benefit to any sector requiring mobile data capture.

## **6. Conclusions**

The growth of the application is indicative of the value that has been added to NGO's that require a low cost accurate system data capture system with quicker turnaround times. Currently the application supports 26 sites across South Africa that actively use the data capture system on a daily basis. These sites are both rural and urban and have shown great promise for extending internationally. These 26 sites to date have submitted over 70 000 forms successfully and managers are increasingly using this system to make key decisions in their organisations, and improve the way they operate.

On the technical front, future work includes increasing the number of handsets and methods that can be used to collect data – such as including SMS input. Furthermore, features can be added to the reporting console that makes data validation and verification easier for NGO Managers.

The EMIT application is currently also used by managers to monitor fieldworker submissions and in doing so they can see how productive a fieldworker is in a particular district. EMIT is also used to collect strategic information for organisations that report this to funders. Future work on the application includes using EMIT to do follow up of patients, Orphans and Vulnerable Children (OVC). EMIT will also allow for cheaper communication between fieldworkers by adding online chat rooms where fieldworkers can seek advice on issues and give feedback to fellow fieldworkers.

In terms of the sector, there is a great need for broad-based IT skills this training is still required at most of the partner NGOs, and could become a core part of the project as it continues to grow.

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## References

- [1] World Wide Worx, 2009, Mobility 2009 Reveals SA's Cellular Gap, <http://www.worldwideworx.com/archives/204>
- [2] Vodacom South Africa, [www.vodacom.co.za](http://www.vodacom.co.za) Accessed on: 10 November 2009
- [3] MTN South Africa, [www.mtn.co.za](http://www.mtn.co.za) Accessed on: 10 November 2009
- [4] Alkhatib, J. et Al., 2008, Open Source: The Next Big Thing in Technology Transfer to Developing Nations, International Association for Management of Technology IAMOT 2008 Proceedings
- [5] MSDN Windows Developer Centre, <http://msdn.microsoft.com/en-us/library/ms997577.aspx> Accessed on 15 February 2010
- [6] Usability Professionals Association, [http://www.upassoc.org/usability\\_resources/about\\_usability/what\\_is\\_ucd.html](http://www.upassoc.org/usability_resources/about_usability/what_is_ucd.html) Accessed on 16 February 2010
- [7] Jones, M., Marsden, G. Mobile Interaction Design, John Wiley and Sons, 2006.
- [8] Bridges.org, 12 Habits of Highly Effective ICT-Enabled Development Initiatives, [http://www.bridges.org/12\\_habits](http://www.bridges.org/12_habits)
- [9] Brown, S., Loudon, M., Sharpey-Schafer, K., Rivett, U. 2007, The Delivery of ARV Dispensing Software: Lessons Learnt from Four Pharmacies in South Africa, IST-Africa 2007 Conference Proceedings, ISBN: 1-905824-04-1