A monitoring and evaluation system for community based organisations

by

Suné Momsen
27036155

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Executive Summary

Heartbeat is a non profit organisation that reaches out to orphaned and vulnerable children in various poor communities in South Africa. The organisation offers a variety of services to children, such as providing food, shelter, emotional support and homework assistance. These services are delivered by Childcare Workers (CCW) visiting the children at their homes. Heartbeat is in the process of improving their monitoring and evaluation system. The organisation is currently experiencing major challenges with regard to data collection. Heartbeat needs to report regularly to external stakeholders, such as government departments and donors. These reports can only be accurate if their database is up to date. Childcare Workers are presently using a paper based system to report on the home visits they make to children.

Management requested a study to determine if mobile technology can be used to replace the paper based reporting system. This document contains a study of literature concerning several mobile technology systems as well as an analysis of the most viable solutions to Heartbeat's reporting challenges.

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Acronyms:

ASC: After School Centre

BPR: Business Process Redesign

CCW: Childcare Worker

CDF: Community Development Facilitator

CHH: Child Headed Household

CHW: Community Health Workers

CI: Continuous Improvement

GPRS: General Packet Radio Service

GPS: Global Positioning System

GSM: Global System For Mobile Communication

IDEF: Integrated Definition

IVR: Interactive Voice Response

NPO: Non Profit Organization

OVC: Orphaned and Vulnerable Child

PDA: Personal Digital Assistant

POH: Potentially Orphaned Household

RHH: Relative Headed Household

SACIN: Sponsor A Child In Need

SAO: Site Administrative Officer

TQM: Total Quality Management

USSD: Unstructured Supplementary Service Data

Chapter 1

1.1) Background

Heartbeat is a non profit organization that works across South Africa to empower and care for orphaned and vulnerable children. Heartbeat has a presence in 7 provinces across South Africa. They strive to assist child and relative headed families that suffer because of AIDS. They accomplish this through the following 4 programmes:

- Child Empowerment (Home visits, support groups, counselling etc.)
- Education (Homework support, holiday school, tertiary education etc.)
- Material support (School uniforms, Stationery, food parcels, nutrition.)
- Access (School fee exemption, Shelter, grants, child care forums)

Childcare workers (CCWs), who are appointed by Heartbeat, visit the children at their homes to help with house and homework as well as check on their emotional well-being. Through these visits Heartbeat can determine what the children's needs are and can work on ways to provide in those needs.

Children enrolled in the Heartbeat program belongs to one of three household categories namely:

- Child Headed Household (CHH): Both parents are deceased and one of the siblings takes care of the others. They are visited 3 times per week.
- Relative Headed Household (RHH): Both parents are deceased and an aunty or grandmother takes care of the children. They are visited once a week.
- Potentially Orphaned Household: Parent/parents are alive but terminally ill. These children are visited once a week.

When an orphaned or vulnerable child (OVC) is identified, they are enrolled into the Heartbeat programme and are registered onto the Heartbeat database. This database holds all vital information regarding the children in the program.

Heartbeat's OVC program receives funding from various donors and resources. They receive financial support from organizations such as the UN Children's Fund, the Nelson Mandela Children Fund, Save the Children (UK), South African corporate sponsors as well as the South African government.

A substantial part of Heartbeat's funds come from an initiative called SACIN – Sponsor A Child In Need. Donors are encouraged towards this sponsorship with the knowledge that their contributions are towards a specific child. In this way individual children are sponsored by a specific benefactor.

1.2) Project aim and objectives

Aim: To implement a mobile technology system that can be used by childcare workers to effectively report back on home visits.

The following points where identified as the main project objectives:

1.2.1) Optimising home visits:

- The current home visiting procedure followed by CCWs should be revised;
- The services delivered by CCWs and the way in which they determine a child's needs should be reassessed by using business process redesign techniques;
- A structured method for CCWs to retrieve information about a child's wellbeing should be developed;
- The current visit assessment form should be revamped;
- Relevant home visit information which is necessary for better service delivery and more effective reporting should be identified and captured.

1.2.2) Visit verification technology:

- A system should be put in place which can monitor that the children, who were reported to have received home visits from CCWs, actually did receive the said visits, thereby increasing the integrity of data gathered on home visits;
- A suitable technology that can verify these home visits should be selected and implemented.

1.2.3) System input mechanism for reporting on visits:

- A suitable mobile technology system should be developed to report on home visits. This system should replace the current 'visit assessment form' filled out by childcare workers on each visit to a client;
- The mobile technology system should enable CCWs to record relevant information gathered on home visits;
- The system should allow CCWs to input data in a specific format or data structure;
- Data quality can be affected by spelling mistakes where free text is allowed, or by a wrong button pressed when a cell phone is used in an Interactive Voice Response (IVR) system. The system should have some control method in place to ensure the quality of the data that is recorded.

1.2.4) Training for CCWs on utilizing the new system:

- In order for the proposed system to function properly, the system users should receive proper training;
- A training manual explaining the workings of the new system should be developed;
- The training manual should inform users of exactly what is expected from them in the new system;
- Any training program or manual for the proposed system should be designed taking into account the users backgrounds and educational levels. It should be kept in mind that CCWs, who will be the primary users of the system, do not all have a high level of literacy.

1.2.5) Effective reporting:

- Data gathered from home visits should be used to update the database on a regular basis;
- If a child's profile is always in an updated state it will be possible to do accurate reporting on a child's current situation at any time;
- This will enable a higher quality of service delivered to a child, improved decision making and more effective resource allocation;
- External stakeholders such as government sponsors and benefactors from the SACIN program will be able to obtain updated reports of services delivered at any time;
- Internal stakeholders such as management will benefit from effective reporting because appropriately designed reports will serve as decision making tools.

1.3) Problem statement

The problem which was identified by Heartbeat and the CSIR lies with the control of the home visits by childcare workers. Childcare workers do not have access to computers and internet. The current method of reporting requires filling out a 'visit assessment form' with each visit to a client. The purpose of this form is to document the present situation in each particular household.

The problem with this method is that CCWs only submit these forms upon visiting the Heartbeat office. This happens at irregular intervals. Management is concerned about the completeness and integrity of these forms, since there is no way to establish whether the reported visits actually took place.

The opposite scenario: that some visits go unreported is also problematic. Accurate and complete information is of utmost importance to Heartbeat, because like all non-profit organizations, Heartbeat is required to deliver proper and accurate feedback to its stakeholders. Government and other sponsors require confirmation that the services they support are actually delivered. Heartbeat management need to base their decisions such as resource allocation on accurate and complete information.

1.4) Project Scope

The task at hand is to investigate the possibility of *mobile technology* as a way to assist and manage CCW's with their home visit reporting. The project involves a *feasibility study* on various forms of mobile technology and to determine whether it can be successfully applied in the Heartbeat set-up. Furthermore an *implementation strategy* should be determined for the feasible options.

The first part of the project entails investigating existing literature to determine what technology is available for the purpose of this project. The focus will be on technology utilising cell phones (mobile technology) since cell phones are available to all childcare workers. Exploring technology using other means such as computers is not included in this project since childcare workers do not have access to computers and are not necessarily computer literate. Two technological capabilities are needed for this project: the first technology should provide the means to deliver current data to the heartbeat database via cell phones and the second should verify that the reported visits actually took place. The implementation of the selected technologies is included in the project scope.

The implementation of the above mentioned technologies will permit an updated database at all times. This will lead to the next part of the problem being addressed, namely the generation of effective reports from the database. Fine tuning of Heartbeat's information system is necessary in order to deliver reports that can:

i.) serve as planning and decision making tools within heartbeat and enable heartbeat to deliver a higher quality of service
ii.) Serve as proof to sponsors and donors that the services they support are actually delivered.

This part of the project will not include physically generating reports and building queries, but will involve the conceptual design of reports in collaboration with management. It also entails deciding which type of reports should be created.

CCWs need to receive training on how to use the new system. Training manuals or user guides should be tailor-made for the CCWs to understand how to use the new system. Proper training material will help ensure the quality and accuracy of data received. The development of a user guide is included in the projects scope.

Chapter 2

2.1) Literature Review

2.1.1) Optimising home visits:

In order to optimise Heartbeat's home visitation procedure, a study was done on how home based care organisations in general, handle home visits.

Research shows that organizations (service providers such as heartbeat) do not use the contact opportunities they have with children to their full extent. Contact sessions should be seen as opportunities to identify, refer, monitor and support vulnerable children (Wilson, Giese, Meintjies, Croke, & Chamberlain 2002:27). A vulnerable child that has received some form of support, like the children in the Heartbeat programme, needs to be monitored in order to see whether the support they've received was sufficient and appropriate (Wilson, Giese, Meintjies, Croke, & Chamberlain 2002:33).

Research on the impact of HIV/AIDS on the psychosocial wellbeing of OVCs has lead to the compilation of a set of measures that are recommended to be used to acquire data on child vulnerability and resilience. Measures include the child's exposure to violence, the child's exposure to harsh punishment or supportive discipline, the caregiver's emotional health, child work and social connectedness (Snider & Dawes 2006:70). The use of these measures should be incorporated in home visits with OVCs.

Home based care organizations recognise the importance of the quality of the service they deliver. In order to gain credibility as an organization within a community, services need to be delivered as promised (Giese, Meintjies, Croke, & Chamberlain 2003:159). To ensure the continuity and quality of care and the protection of children that are serviced by community/home based caregivers, home based caregivers should work in teams and they should be assisted by professionals and para-professionals (Giese, Meintjies, Croke, & Chamberlain 2003:245).

Heartbeat's home visits can be optimized by learning from and applying the principles discussed above.

2.1.2) Visit verification technology

Heartbeat's monitoring and evaluation problem with regards to the home visits conducted by childcare workers, led to exploring different ways to ensure that recorded visits to children, were actually made. Mobile technology that is available on the market today is explored as possible verification methods.

GPS (global positioning system) – GPS technology was developed in the 1980' by the US department of defence. Since then the technology has been successfully applied to a

number of different fields. GPS can be used to communicate the exact location of a person or vehicle. GPS has been used in conjunction with PDA's (Personal Digital Assistant's) to track the movement of people as part of a household travelling survey for the US Federal Highway Administration (Stopher 2004:435). GPS enabled cell phones have been successfully used to track medical patients with dementia. The exact position of a GPS enabled cell phone can be located to within 5 metres (Miskelly 2005:497).

Location based services – Not all mobile phones have GPS capabilities, therefore other methods of location tracking is also explored. All cell phones make use of a GSM (Global System for Mobile Communication) network. The signal received by cell phone towers from a specific mobile phone can be used to track the location of this specific mobile phone. Using GSM for data collection purposes has some inherent disadvantages: the accuracy of pin-pointing a location is very dependent on the density of cell-phone towers (base stations) and the quality of the cell phone signal in the study area. Urban areas with few base stations can render rather poor positional data (Krygsman & Schmitz 2005:698,699). Location based services offered by South African mobile service providers, such as Look4Me by Vodacom can do a location search with an accuracy of 120m with good cell phone reception. In more remote areas the accuracy of the results of a location search can be as wide as 30km (VODACOM'S LOOK4ME PROMISES PEACE OF MIND, 2004).

RFID (Radio Frequency Identification) – RFID technology is relatively new to the market but has been found useful in a wide range of applications. An RFID system consists of two main components, namely a transponder, which is attached to the object that is being tracked, and a reader. The reader has the ability to use energy to penetrate the object and read the RFID tag even when it's not directly visible, thus identifying the object without having to read a bar-code. The use of RFID tags in the Logistics and Supply Chain Management industry has increased significantly during the last few years. RFID technology is used in container depots to track and identify empty shipping containers. (Ngai, Cheng, Au, & Lai, 2007:65) Other sectors such as the health industry have also discovered the value of RFID technology. Hospitals have made use of RFID tags during disaster periods to monitor and track resources, patients and personnel (Fry & Lenert 2005:261). By issuing someone with an RFID tag, their exact location can be established at anytime.

Bar coding – Groundbreaking discoveries have been made in the area of bar coding technology over the past few years. Cell phone cameras can now be used as bar code scanners. Even though most mobile phones' image quality is rather poor, technology has advanced to such an extent that bar codes can be read even from very poor images (Adelmann, Langheinrich, & Florkemeier [sa]:3). Sometime in the future bar codes will be made redundant by RFID technology whose reading and identifying skills are more advanced, however presently bar coding is the most used identification technique because it is much cheaper than RFID (de jager, Lamprecht, & van Dyk, 2005, pp. 2-9). Virtually every item in a supermarket has an internationally recognised bar-code printed on the label. Because separate laser scanners aren't necessary anymore for optical bar code recognition,

bar coding has proven to be useful in a large range of applications, stretching far beyond its' use at a supermarket check-out line. (Adelmann, Langheinrich, & Florkemeier [sa]:3) Bar codes are printed on business cards, and by simply using your cell phone's camera as a scanner, the barcode is translated and the contact details given on the business card is saved to your phone. Museums mark certain exhibits with bar codes which museum goers can then scan with their cell phones to receive additional information about the specific piece. Software downloaded to your cell phone can decipher the bar code and wireless networking technologies such as 3G , Bluetooth or GPRS can be used to retrieve data that was selected via the bar code (Toye, Sharp, Madhavapeddy, Scott, Upton, & Blackwell 2007:98). It is predicted that in the near future this technology will be used in cell phone SMS competitions. For example Coca Cola launches a competition and prints a unique code on the back of the label of each bottle of Coke. Rather than sending this code that enters you into the competition via SMS, a photo can be taken of the bottle's barcode and this image can be sent via MMS (Rohs & Gfeller [sa]:3).

2.1.3) System input mechanism for reporting on visits

Mobile technology that can serve as input mechanism for home visit reporting is researched below:

IVR (Interactive Voice Response) – This automated telephone system has an electronic voice asking questions from a pre-recorded (computer) script that can be answered by respondents by pressing corresponding buttons on their phone's keypads. It is a computerized data collection tool that has been used since the late 1990's for survey research. It is also used to gather information that is not for survey purposes, such as Airline reservations or catalogue sales (Tourangeau, Steiger, & Wilson [sa]:265). IVR has several advantages such as cost effectiveness, autonomy, confidentiality, improved quality of data and its multi lingual interfaces. A respondent can proceed through an interview on his/her own time and because there is no personal contact with an interviewer, unbiased responses can be obtained. The setup of a basic IVR system consists of a computer which has a voice card installed and software that is installed on the computer which enables the voice card to connect to multiple phone lines. Calls can then be made and received automatically (Corkrey & Parkinson 2002:243). IVR systems can receive information from inbound calls. The information supplied by callers can be used to update information systems. (Corkrey & Parkinson 2002:344). The one big drawback of IVR technology is that as the functionality of an IVR system increase, the number of voice prompts sent to a caller gets more and the messages also become more complex. This makes it slower and more troublesome for a customer to complete an interview (Porter & Weiss 1998:32). The healthcare industry refers to IVR systems as telehealth systems. Telehealth can be used by patients to report medication compliance etc. This allows doctors to keep track of patients without actually speaking to them (Lee, Friedman, Cukor, & Ahern 2003:277).

Java applications/Web-based mobile system – Java is a programming language specifically designed for the internet environment. The Java programming language can be used to create applications that can run on a single computer or on a server that distributes it to multiple users (Holz, Hildebrandt, & Weber 2006:138). Java applications can be installed on any cell phone that is enabled for the Java programming language and has access to the internet. A study has been done to determine the feasibility and practicality of using mobile phones as a tool for data collection. The study involved Community Health Workers (CHW) conducting a large survey by collecting data using cell phone technology. A web-based mobile system, using Java as programming language, was installed on the entry level cell phones of the CHW's that participated in the study. The web-based system/application that was used for the study is called "Mobile Researcher" and was designed by a private digital solutions company. The application allows electronic questionnaires that are created on a word processor to be sent wirelessly to the handsets of the study participants (the CHW's). Once the questionnaire is on a cell phone, they can be completed as interviews take place. Completed questionnaires are automatically uploaded to a server (host computer) via GPRS (General Packet Radio Service). Survey completion takes place offline; no internet connection is needed for the questionnaire to be filled in. This means that a survey can be completed in rural areas with no cell phone reception. In such cases the completed surveys are saved securely on the phone until a signal is found. As soon as the cell phone receives signal, the completed surveys that was saved to the phone are uploaded to the server. Data can be exported from the server in standard file formats such as excel. Figure 1 below, shows what a phone with Mobile researcher on will display when the application is running (Tomlinson, et al. 2009:1-3).

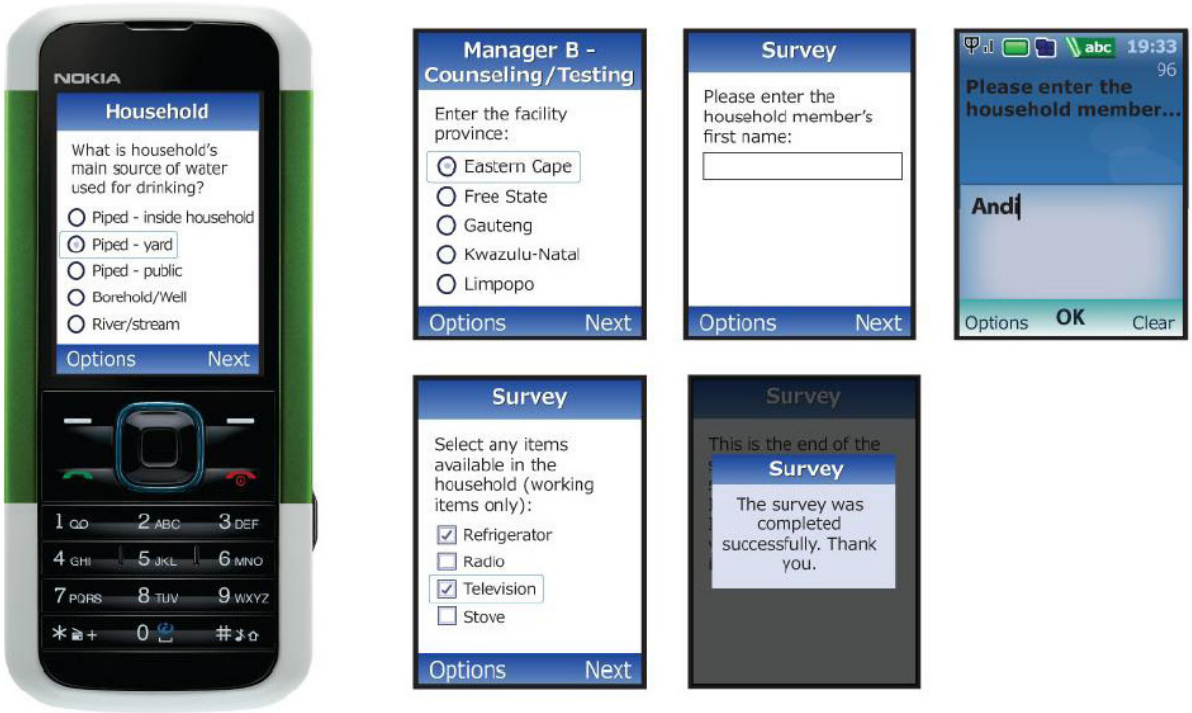


Figure 1: Screen shots of a survey on a cell phone

USSD (Unstructured Supplementary Service Data) – USSD is a technology that makes use of the signalling channels of the GSM network to transmit information (Mobile in a Minute). The technology is commonly used to check the balance of a prepaid cell phone account and to send a "Please call Me". USSD enables very fast (real time) interaction between a user and an application, the interaction is initiated by the user accessing the USSD application and data is exchanged by selecting an option with the cell phone key pad (Loudon: 2009). Most USSD services are menu based.

In Mpumalanga a home based care initiative is using USSD technology to monitor patients. Once a patient is discharged from hospital, he/she is assigned a caregiver. This caregiver is equipped with basic medical equipment. The caregiver then visits the patient at his/her house and measures the patient's vital signs. After the caregiver has taken the measurements, the caregiver will access the USSD patient monitoring system by dialling a specified number from his/her personal mobile phone. The measurement of the patient that had just been taken is then submitted via the USSD service, following the given menu structure. Once the data has been submitted sisters at the hospital will have immediate access to the patient information via a desktop computer which is linked to the server where data is stored. This enables diagnoses to be made earlier, better treatment to be given as well as reduced travelling costs for patients. Figure 2 shows how the USSD menu appears on the caregiver's cell phone (Wouters, Barjis, Maponya, Martiz, & Mashiri: 2009).

a. Calling the number | b. Request for patient number | c. Main menu for 'patient Fakes' | d. submenu 'temperature' | e. Main menu after entering all vital signs

Figure 2: Screen shots of the USSD menu on a caregiver's cell phone

2.1.4) Training for CCWs on utilizing the new system:

Training material for the new system should be developed taking the users' backgrounds and education levels into account. CCW's do not all have a high level of literacy. Communication with people with low literacy skills are explored in the following literature.

Studies in the health industry have shown the importance of providing literature and materials suitable for patients with a low level of literacy. Most health literature (informational pamphlets etc) is written for a reading level beyond 10th grade

comprehension. It was found that 30-50% of people using health literature are not able to read at this level. Communication needs to be improved so that everyone can understand it. People at higher literacy levels also welcomes simplicity, and prefer shorter and better focused reading material (Plimpton & Root 1994:86). A study of health material yielded the following typical mistakes that account for their high level of reading difficulty: Information overload, complex sentences, technical jargon, small print and unclear illustrations (Plimpton & Root 1994:88). These are common mistakes that should be avoided in environments (like that of Heartbeat) where low literacy readers are expected to understand the reading material given to them.

2.1.5) Effective reporting:

Heartbeat requires an effective reporting system in order to be accountable to all their various stakeholders and improve management decision making based on quality and complete data. Literature is explored on the accountability of NPOs (Non Profit Organizations) in general:

NPO's are accountable to a number of sometimes conflicting groups. Table 1 (Conroy 2005:9) shows three categories of stakeholders to which NPO's are accountable.

Higher Authority (external)	Higher Authority (internal)	Public
• Courts • Parliament • Regulatory agencies • Funding agencies • Accrediting agencies • Professional bodies	• Management committee/Board • Trustees • CEO • Members • Volunteers • Employers	• Private donors • Clients • Taxpayers • Clients family/friends • Media

Table 1: Multiple Stakeholder Accountability

Performance measurements are needed in order to measure accountability to each of these stakeholders. Most NPO's track their performance in terms of membership growth, people served, money raised, programs run and overhead costs. However, these measurements don't measure the extent to which an organization has achieved its mission and are often not key to NPO's performance. Performance measures vary from organization to organization, as the particular stakeholders also vary, but it has been determined that the general effectiveness and the efficiency of an organization can be measured by answering the following questions (Conroy 2005:12):

1. How is "public" money being spent on programs and services?
2. What outcomes are being delivered to clients in need?

3. How can the standard of the services delivered be measured?
4. Can proof be delivered that the NPO deserves exemption from tax based on the "public benefit" test?

NPOs often lose sight of their responsibility to report to donors. After the September 11 attacks the American Red Cross received US$546 million to aid victims of the attacks, but only used US$300 million for that purpose. In Australia it was discovered that the Red Cross only used 54% of the money they received to help victims of the Bali bombing attack. $6.6 million are unaccounted for (Conroy 2005:7). This points to the importance that NPO's should be held accountable to their donors/stakeholders through effective reporting.

2.2) Literature Review: Engineering tools and techniques

2.2.1) Business Process Redesign (BPR):

In recent years many organizations all over the world have made an effort to redesign their operational processes in order to improve their competitive position. Many have turned to the use of Business Process Redesign (BPR). BPR refers to the attempt to enhance organisational performance by improving the effectiveness, efficiency, and adaptability of key business processes.

In the course of redesigning an organization's business processes, changes need to be implemented. Some organizations use top-down initiatives to implement far reaching, radical change (sometimes referred to as process innovation) and other organizations use more subtle, small scale interventions (continuous/incremental improvements) to bring about the desired improvement in their processes (Watell, White, & Kawalek 1994:23).

BPR has also been successfully applied in the non-profit sector. A study was conducted in 60 hospitals in Tennessee on the use of managerial tools/philosophies such as Total Quality Management (TQM), Continuous improvement (CI), benchmarking and BPR. The results of the study shows that 30% of non-profit Hospitals have attempted to use BPR to improve their business processes and almost 70% of these attempts resulted in success (Yasin, Zimmerer, Miller, & Zimmerer 2002:271).

Several different BPR methodologies exist. The basic concept followed in most BPR methodologies is to: Form a detailed understanding of the problem situation, to develop conceptual models based on what *ought* to be, and to then compare To-be scenarios with the current reality, suggesting practical courses of action to get to the improved state.

A consolidated methodology compiled out of 5 different BPR methodologies, follows the following approach (Mutha, Whitman, & Cheraghi 1999:2-4):

1. Planning and preparation
2. Analysing and understanding the As-Is scenario
3. Designing the To-Be process
4. Implementing the redesigned process
5. Continuously improving the process

In the quest for continuous improvement, organizations should always be on the look-out for new ways to improve their business processes. BPR techniques can offer valuable insight to such organizations. Heartbeat can make use of BPR techniques to improve the entire process currently followed by CCWs to do home visit reporting.

2.2.2) UML diagrams:

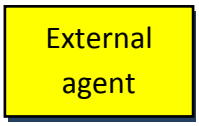
For any system to function properly, system users need to understand the system and agree on the value of the system. Use-case modelling is one of many tools that a system designer can use to illustrate the workings of a system to the system users and other stakeholders. Use cases have the unique ability to help teams understand the value of a system, because use cases describe how users should use the system as well as what the system can do for the users (Bittner & Spence 2003:xiii). The basic concept behind use-case modelling is that you should first focus on who will use a system, or what the system will use, to get to the heart of what a system must do. Secondly you look at what the system must do for those users. Use-case models consist of the following two components: *actors* (the people or things that interact with a system) and *use cases* (the things/activities that the system performs for the actors). Actors and use cases are depicted in Use-Case Diagrams to summarize what a system will do. Use-case modelling is a powerful, yet simple way to express the functional requirements of a system (Bittner & Spence 2003:1-4).

Use cases can be used in the BPR process to illustrate and compare the As-Is and To-Be processes.

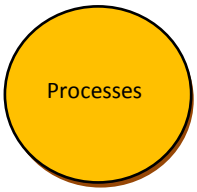
Activity diagrams are another example of a UML diagram that can be used when modelling the Heartbeat case. It can be used in conjunction with use-case diagrams, to depict the sequential flow of the activities modelled in the use-case. It is also used to model the logic of the system (Bentley & Whitten 2007:382). Swim lanes can be used in the activity diagrams to divide the activities/processes between actors.

2.2.3) Data flow diagrams:

A data flow diagram is a tool used to depict the flow of data through a system. It also shows how data is processed in the system. Data flow diagrams are very easy to read because they comprise of only three symbols and one connector. The symbols are illustrated below:



The external agent can be a person/organization/other system that lies outside the system, but interacts with it. External agents provide input into the system and receive the outputs.



The circle represents the work or processes to be done. When data passes through a process, the data is often transformed into another format.

Data stores are represented by these open-ended boxes. A data store is like an inventory of data that is stored to be used at a later stage.

The arrow indicates the flow of data as inputs and outputs of the processes.

The processes in a data flow diagram can operate in parallel, the dataflow diagram does not give a sequential representation of the system, and it only shows how data moves around in a system. The processes in the diagram can also have vastly different timing; some processes can happen daily, other can happen hourly/monthly (Bentley & Whitten 2007:317-320).

2.2.4) IDEF0 models:

IDEF (Integrated definition) modeling techniques are used to enhance communication between stakeholders trying to understand the system. IDEF is also used for documentation, design, planning, and analysis. IDEF0 is the IDEF method used for functional modeling. IDEF0 models the actions, decisions, and activities of a system, to communicate the functional perspective of a system.

IDEF0 models describe:

- the functions that are performed;
- everything that is needed to perform those functions,

therefore it is created as one of the first tasks of a system development effort (Demirag, Johnson, Nazzal, & Wan 1-11).

An IDEF0 model consists of a hierarchical set of diagrams, the context diagram being the highest level diagram and the leaf diagrams being the more detailed diagrams. A diagram above a specific other diagram is called a parent diagram, the bottom diagrams are called child diagrams. The context diagram (highest level diagram) has one box and all other diagrams, called decomposition diagrams have no fewer than 2 and no more than 9 boxes (Myers 2006:41-50). IDEF0 diagrams consists of activity boxes and arrows, the boxes representing the activities that the system performs, and the arrows the inputs, outputs, mechanisms and controls of these activities. Figure 3 shows the makings of a basic context diagram. The hierarchical nature of an IDEF0 model, allows the system to be refined into more detail until the model is as descriptive as necessary. Figure 4 below shows how parent and child diagrams are linked in the decomposition diagrams (Demirag, Johnson, Nazzal, & Wan).

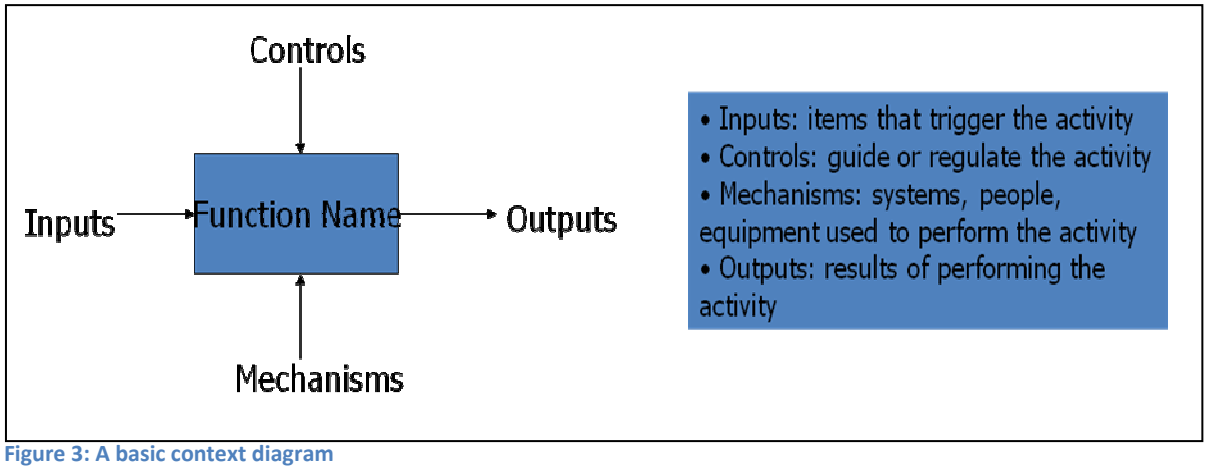


Figure 3: A basic context diagram

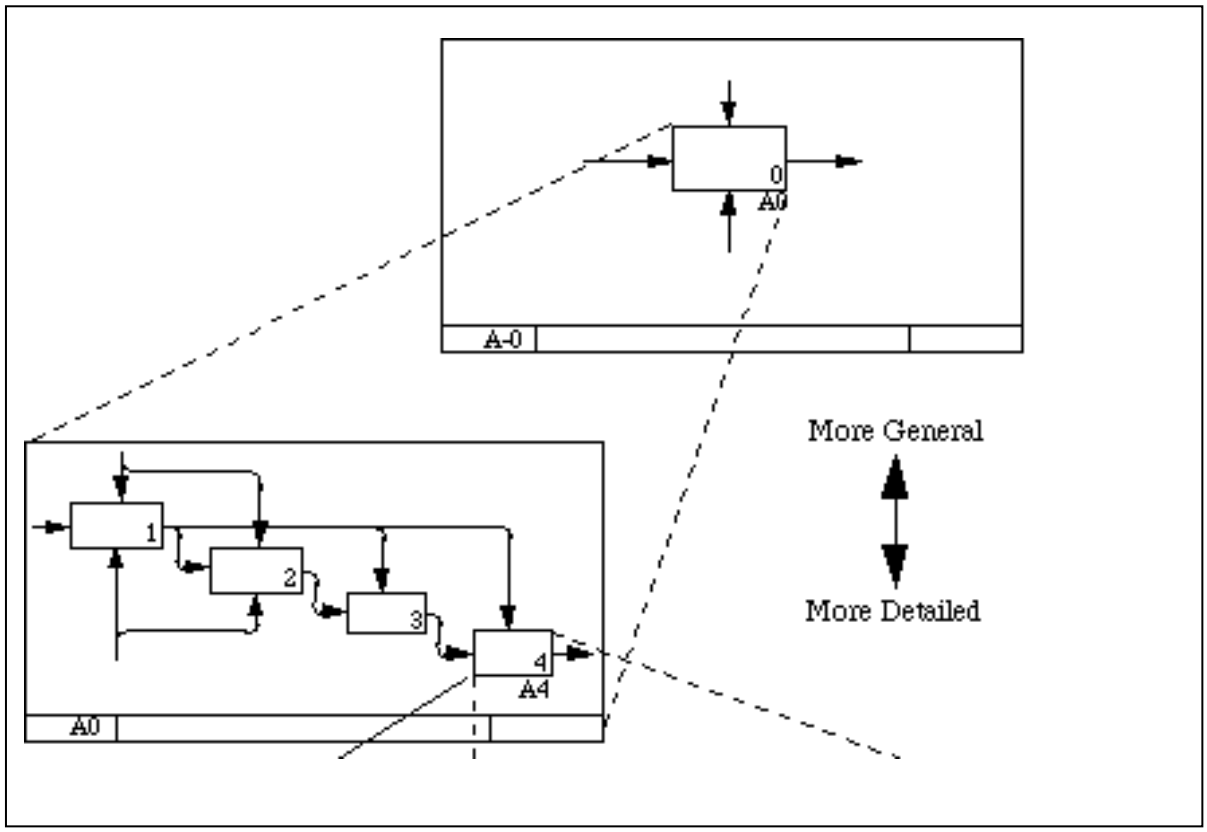


Figure 4: Decomposition diagram

2.2.5) Feasibility analysis tools:

Cost-Benefit Analysis – The cost benefit analysis is a quantitative approach to determining the best alternative from several alternatives. The approach follows five steps:

1. Determine what changes (due to better design) each of the alternatives bring about.
2. Quantify these changes (benefits) in terms of monetary units.
3. Determine the cost required to implement the above mentioned changes.
4. Create a Ratio for each alternative by dividing the cost by the benefit.

5. The smallest ratio indicates the most desirable alternative (Niebel & Freivalds 2003:336).

Value engineering – A process of evaluating alternatives by applying numbers and forming a payoff matrix. Alternatives are compared with each other by following the steps below:

1. Determine a set of benefits that are obtained when choosing an alternative (for example: low cost, good quality, decrease in injuries).
2. Assign a weight to each benefit. A benefit that is considered the most important is assigned the highest value.
3. Create a matrix with the alternatives and the benefits of the alternatives.
4. Score each alternative in terms of the benefit they deliver.
5. Multiply the score with the appropriate weight.
6. Sum all of the products to get a final score for each alternative.
7. The highest final score indicates the best alternative.

It is important to note that the relative weights that are assigned to the benefits will differ for each unique case (Niebel & Freivalds 2003:335).

These two techniques are both valuable in the process of deciding between several alternatives. They can both be used in the Heartbeat context to select the most appropriate technological system from all the options that are discussed in section 2.1.2 and 2.1.3. The principles of value engineering will be used in Chapter 5 to reach an informed decision regarding the most suitable Mobile technology for Heartbeat.

Chapter 3:
3.1) The As-Is scenario

3.1.1) Understanding the existing process:

Before attempting to change anything, it is necessary to have a thorough understanding of the current process Heartbeat follows in order to do their reporting on home visits. In simple terms, the procedure currently followed by CCW's are as follows:

1. The CCW goes to the child's house and conducts the home visit.
2. While at the child's house the CCW is supposed to fill in the services that were rendered during the visit on the Visit Assessment Form (however management suspects the visit assessment form is only completed at a later stage) and the child is supposed to sign underneath.
3. Completed Visit Assessment Forms are given to the Site Administrative Officer (SAO)
4. The SAO collates all the Visit Assessment Forms received
5. The summary is sent to the Heartbeat Head office (via fax, e-mail, post, courier services or personal delivery, depending on the services available at the different sites.) This happens at irregular intervals.
6. Once the Head office receives the summary it is processed and captured onto the database.

The problems experienced with the above system/procedure are mapped below in the Fishbone diagram in Figure 5:

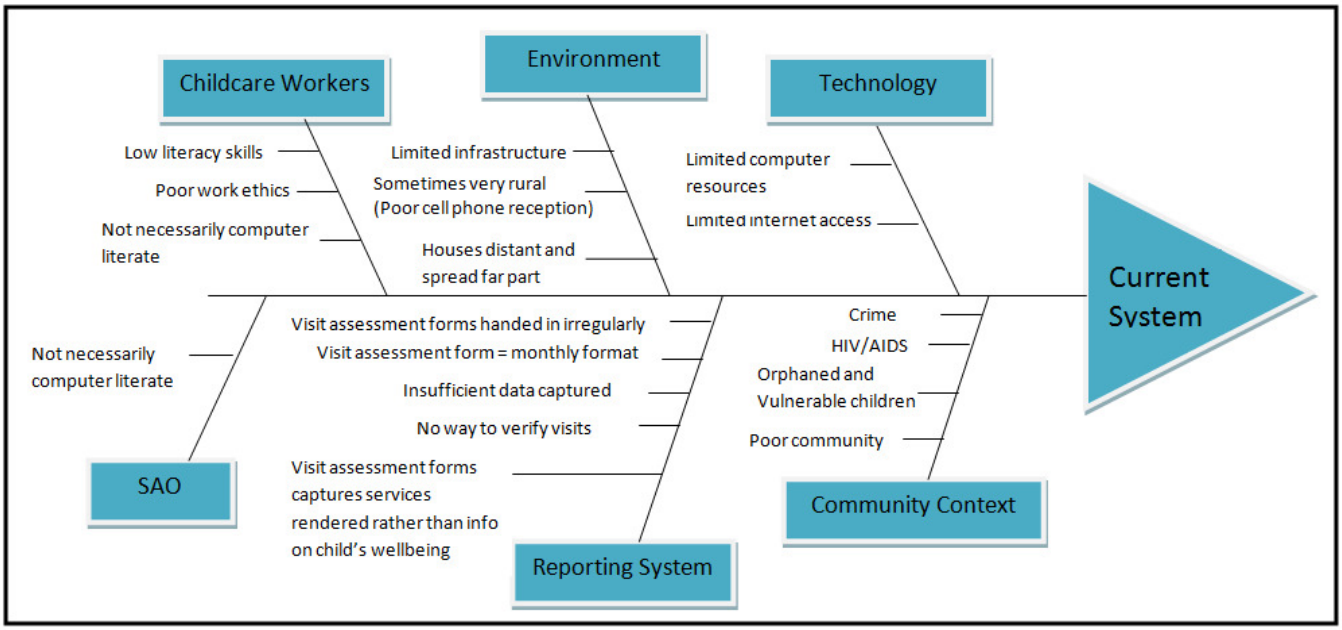


Figure 5: Fishbone diagram of the problems with current system

The fishbone diagram, also known as the Ishikawa diagram is used to identify, analyse and solve problems. The diagram begins with the problem experienced drawn to the right hand side of the diagram as the 'head' of the fish. The possible causes of the problem are drawn as the 'bones' off the main 'backbone' of the fish. Other possible causes are then drawn around the main 'bones'.

3.1.2) Modelling the existing process:

For a more in depth understanding of how the above mentioned system works, different modelling techniques are used to analyse the process.

The activity diagram in Figure 6 shows all the actors involved in the current process (with the use of swim lanes) as well as the tasks that they perform and the order in which they are performed.

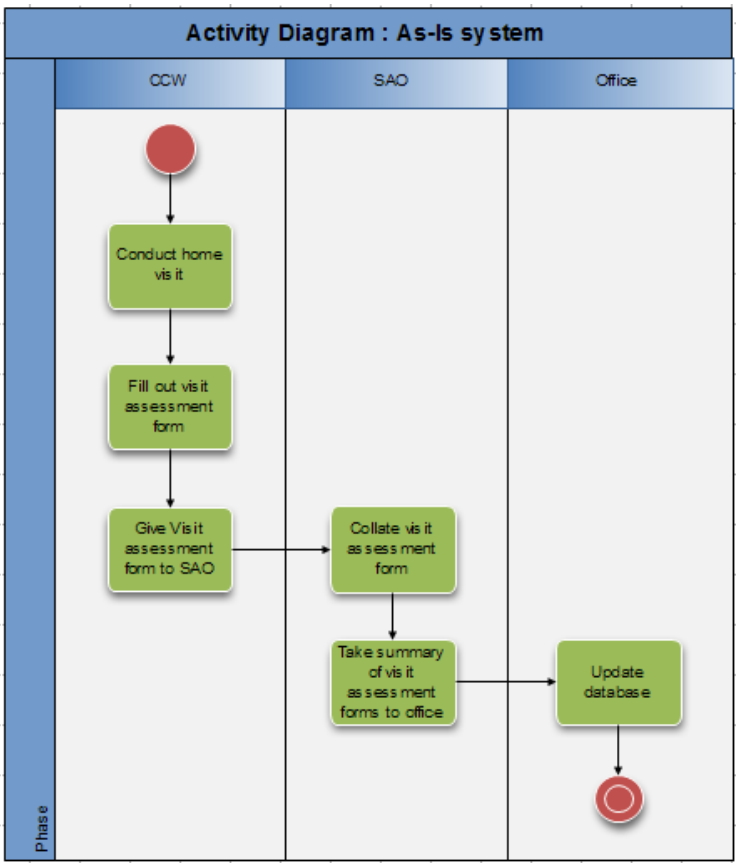


Figure 6: Activity diagram of current system

The activity diagram shows CCWs, the SAO and the office personnel all play a vital role in getting the database to an updated state. Removing the SAO as middleman and getting an automated system to update the database could largely reduce the percentage of human error.

A data flow diagram indicating how data flows between external agents, processes and data stores in the current system is shown in Figure 7.

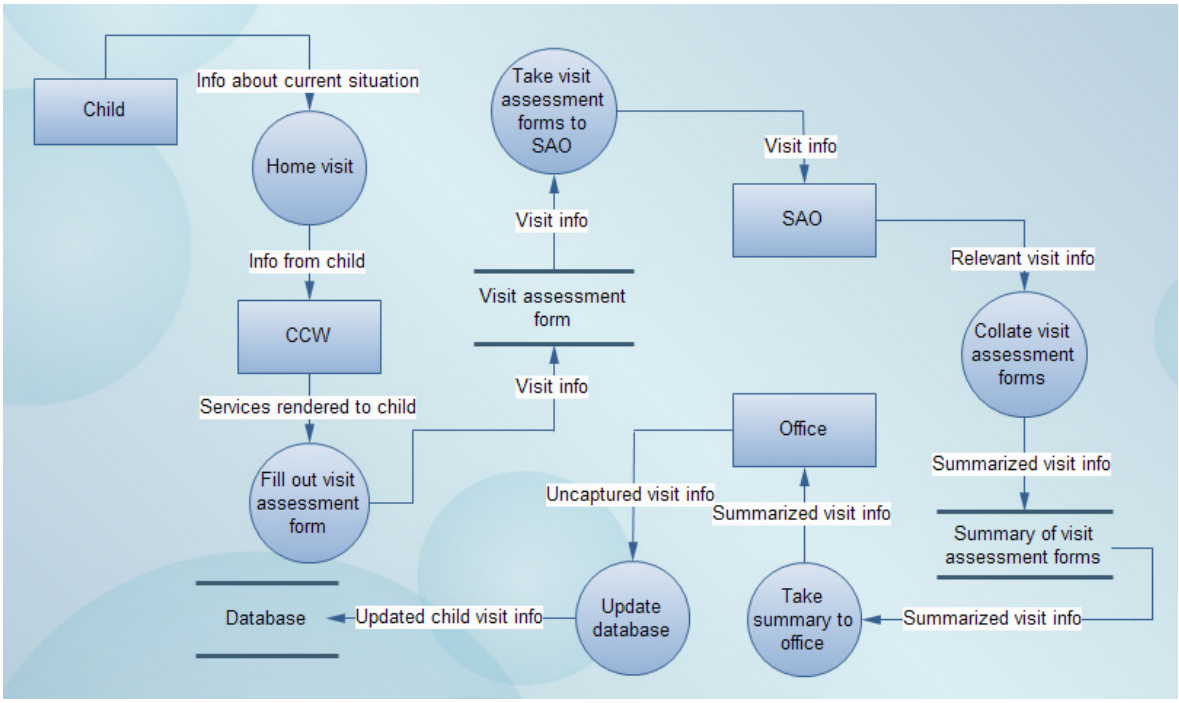


Figure 7: Data Flow Diagram of current system

The most valuable insight gained from this diagram is that the data gathered by the CCW from the child is captured as 'services rendered'. No direct information regarding the physical or emotional wellbeing of the child is captured in this current reporting system. It should also be noted that only some 'relevant' information is taken from the visit assessment form and stored to the summary of the visit assessment forms that the SAO compiles. The current visit assessment form and an example of a monthly summary are added under section 3.1.3.

To further illustrate the current system an IDEF0 model was created:

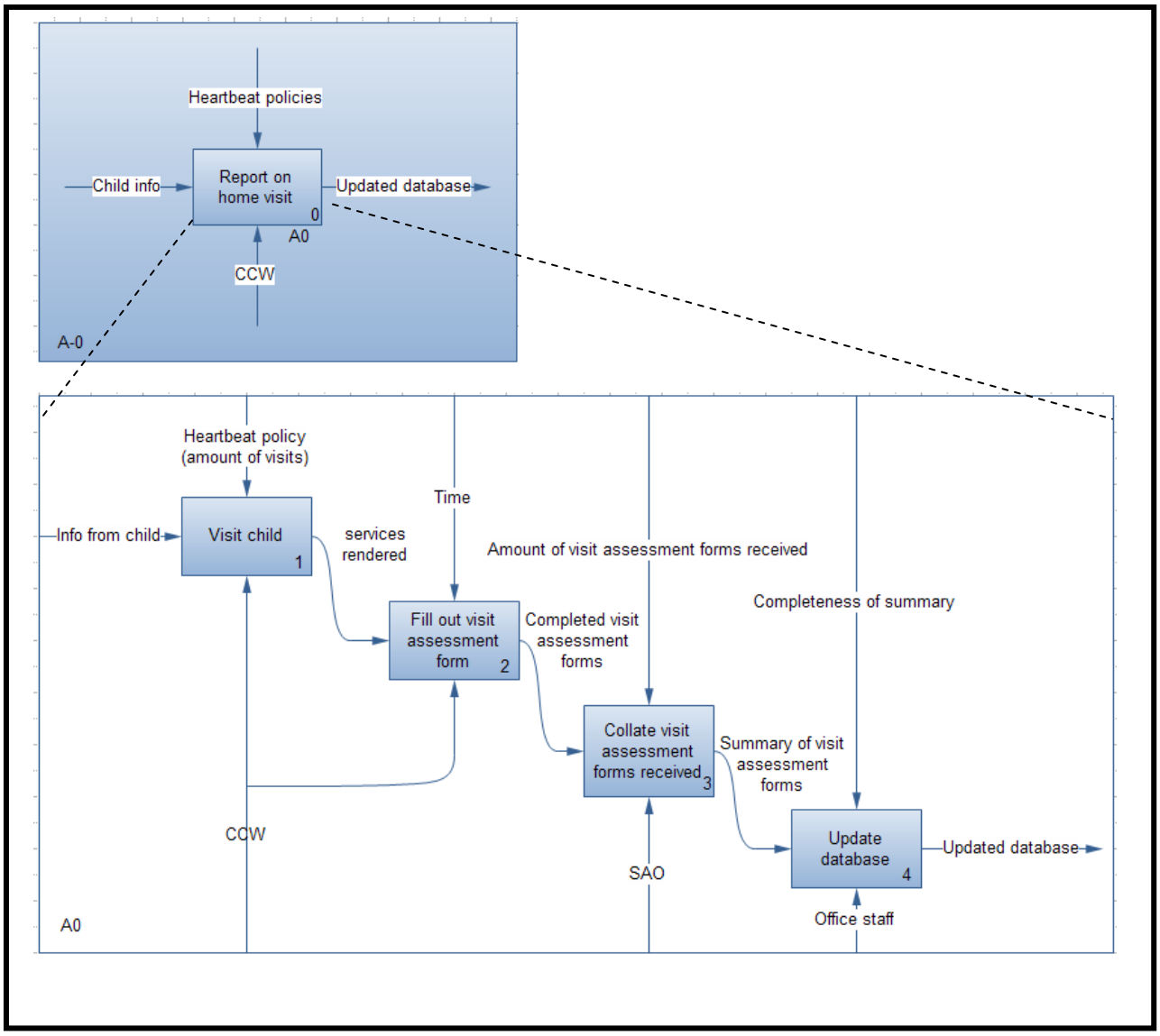


Figure 8: IDEF0 model of current system

The model above illustrates the inputs, outputs, resources and controls of the different activities taking place in the current reporting system. It should be noted that the output of the home visit (the 'visit child' activity box) is information on the services rendered during the visit. No direct information regarding the wellbeing of the child is necessary as input for the visit assessment form.

3.1.3) Assessing the current documents:

The current visit assessment form (Figure 9) and an example of the summary of the visit assessment forms (Table 2) are displayed on the following pages.

HEARTBEAT

HEARTBEAT HOME VISIT ASSESSMENT FORM

NAME OF CHILD VISITED: | CHILD SURNAME:

CHILD'S UNIQUE HB IDENTIFICATION NUMBER: | EMPLOYEE NAME AND SURNAME: | MONTH:

PROJECT NAME: | TYPE OF HOUSEHOLD: please ✓ one — Child Headed | Relative Headed | Potential Orphan | Youth Headed | CCW Child

SERVICES RENDERED		DAY OF THE MONTH - Please indicate total time spent (TS) at the home of the child																															TOTAL NUMBER OF DAYS
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	
		TS	TS	TS	TS	TS	TS	TS	TS	TS	TS	TS	TS	TS	TS	TS	TS	TS	TS	TS	TS	TS	TS	TS	TS	TS	TS	TS	TS	TS	TS	TS	
If absent, state reason: Sick=S;Visited Friends=VF;Other=O																																	
Access	Referral: Child Support Grant (CDF)																																
	Referral: Foster Care (CDF)																																
	Referral: Disability Grant (CDF)																																
	Referral: Birth Certificate / Clinic Card (CDF)																																
	Assess Condition of Shelter																																
	Referral: Shelter repair/rent money/build																																
	Succession and inherritance planning																																
Psychological	Referral: To Social - / Auxiliary Social Worker																																
	Basic Counselling at Home																																
PSS	Provide Child Protection Information to OVC																																
Health care	ART Adherance Councelling																																
	ART Support and Monitoring																																
	Referral: Clinic																																
	Referral: Doctor																																
	Referral: Immunisation																																
General	Household chores																																
	SACIN (Kiz -Up/Children profiles)																																
Educational	Home work assitance																																
Other:	Specify:																																
TOTAL TIME SPENT AT HOME (Completed by the CCW'er):																																	
CHILD'S /GUARDIAN INITIALS PER VISIT:																																	

Child's signature at the end of the month

Date (at the end of the month):

Heartbeat staff signature at the end of the month

Position in Heartbeat:

Date (at the end of the month):

Project site: Admin Use Only

Checked by (name and surname):

Position in Heartbeat:

Date:

Signature:

Captured by (name and surname):

Position in Heartbeat:

Date:

Signature:

Head Office Use Only

Date:

M&E Officer signature:

Figure 9: Current visit assessment

Reporting Date	Child ID	Child	Crèche Placement	Holiday School	Homework Assistance	Group Therapy	Individual Counselling	Children's Workshops	Puppet Show	Youth Camp	Memory Work	Abuse Response	Support Groups	Child participation workshop	Child protection workshop	ASC Visits (Number of)	ASC Meals (Number of)	Toy Libraries (Number of)	Academic Libraries (Number of)	Guardian counselling (Number of)	Home Visits (Number of)	Granny's support group (Number of)	Children activity	Dancing	Drama	Computer	Poetry
7/2010	7025	Aaron,Frans														0	0	0	0	0	2	0					
7/2010	7026	Aaron,Thabongi								1						3	3	0	0	0	2	0					
7/2010	7082	Adams,Eve														2	2	0	0	0	3	0					
7/2010	7083	Adams,Letty														3	3	0	0	0	3	0					
7/2010	1066	Beleme,Itumi														2	2	1	0	0	2	0					
7/2010	6835	Blou,Funila								1						5	5	0	0	0	3	0					
7/2010	11185	Budlela,Nomsi														6	6	0	0	0	1	0					
7/2010	34681	Chabeli,Nthabalang								1						1	1	0	0	0	4	0					
7/2010	30719	Disenyane,Moipolilo														5	5	2	2	0	3	0					
7/2010	30653	Dukani,Sabetina														1	1	0	0	0	2	0					
7/2010	30654	Dukani,Sidney														1	1	0	0	0	2	0					
7/2010	9450	Goeman,Dorah														1	1	0	0	0	0	0					
7/2010	30734	Hlao,Shuan								1						6	6	0	0	0	3	0					
7/2010	25337	Hlao,Timothy														6	6	0	0	0	3	0					
7/2010	31504	Howard,Rebecca														0	0	0	0	0	3	0					

Table 2: Sample of a summary report from one of the sites

Observations on the visit assessment form:

As mentioned before, the information that the visit assessment form captures is the services that were rendered by the CCW during each visit. When looking at the form in Figure 9 one will see that nowhere on the form there is room to document or report on the physical or emotional wellbeing of the child. The only reference one has to the child's psychological welfare is the two boxes marked 'referral to social/auxiliary worker' and 'basic counselling at home'. There is nowhere to report whether the child is happy or sad or lonely or depressed.

There is nowhere to report whether the child has been fed that day, or whether they have any nutritional food in the house.

The health care division of the form only lets the CCW mention if a referral to a clinic/doctor has been made, there is no place to actually report whether a child is healthy or sick or how he/she is growing in comparison with his/her peers.

Several of the fields on the form, especially the ones in the Access division are redundant. Events such as getting a child a birth certificate or a foster care/disability grant are likely to only happen once in a child's life, therefore it is unnecessary to have it as a field on a visit assessment form that is filled in on a weekly basis.

It should also be noted that only one visit assessment form is given per child, per month: this means that even if the form is filled in perfectly and handed in promptly at the end of the month (which rarely happens); the database can only be updated once a month.

Observations on the summary report:

When comparing the visit assessment form with the summary report, one should notice that the only thing that gets captured from the visit assessment form in Figure 9 to the summary report in Table 2 is the columns highlighted in Table 2 above, namely the number of visits made during the month and the two services rendered; Homework assistance and Individual Counselling. All other information captured on the visit assessment form is lost. Therefore there is no sense in capturing it in the first place.

3.1.4) Contents of a home visit:

Management prescribes that the following content gets covered by a CCW during each visit. The CCW must:

- Assess the *social*, *educational* and *physical* circumstances of the household;
- They must assist, guide and motivate the child in future planning;
- Attend to and address any problems/concerns, and
- Refer children to a Social Worker or CDF (Community Development Facilitator) for services when needed.

However in reality, the above mentioned list is not followed by all CCWs. Most CCWs have their own understanding of what is expected from them during a home visit; this does often not match up to management's expectations. As is clear after assessing the current visit assessment form, there are no guidelines on the form to guide a CCW through the visit and to assist him/her in covering the content that management prescribes. If the visit assessment form was designed in such a fashion that it will direct the CCW to address the above mentioned content, it would be easier for CCWs to deliver a better service.

3.1.5) Cost analysis

The table below gives an estimate (actual costs were not available) of the monthly costs that are associated with the current reporting system. The cost items are mainly the cost of printing of the visit assessment forms and the costs associated with getting the summary report to the head office. Because different methods are used by all 14 of the different Heartbeat sites, the costs to get the summary report to the Heartbeat head office, widely differs between the different services used.

Item	**Rate**	**Amount**	**Cost**
Printing of visit assessment form	20 cents per page	4900 copies	R 980
Fax of the summary report	R5 per page	50 pages	R 250
Courier costs for summary report			R 500
Petrol expenses	R1 per kilometre	400 kilometres	R 400
Postage costs for summary report			R 50
Internet usage to e-mail the summary report	R1 per minute	30 minutes	R 30
Total			**R 2210**

Table 3: Cost analysis of current system

Chapter 4:
Analysis of Mobile Technology
4.1) Analysis of Verification Technology

After studying the literature in Chapter 2, two technologies that can be used to *verify home visits* are selected. Since four different technological capabilities for verification of the home visits were researched, only the two most feasible options are selected for further analysis, the selection process is shown in the feasibility analysis matrix in table 2 below:

Criteria	Weight	GPS	Location based services	RFID	Bar-coding
Cost	**20%**	20% Expensive	50% Not to expensive	20% Expensive	70% Affordable
Infrastructure needed	**30%**	50% Cell phone with GPS	100% Any cell phone	20% Tag Reader required	90% Almost any cell phone
Ability to be used in conjunction with other technology	**10%**	90% Very possible	70% Possible	40% Possible but difficult	70% Possible
Effort to use	**10%**	100% No effort	100% No effort	60% Some effort	60% Some effort
Efficiency(accuracy)	**20%**	95% Very accurate	20% Not very accurate	80% Very accurate	70% Accurate
Need for a service provider	**10%**	80% No	20% Yes	80% No	80% No
Total		**65%**	**63%**	**44%**	**76%**

Table 4: Selecting a verification technology

Feasibility criteria are listed in the left hand column, a weight is assigned to each of these. Each alternative technology is given a score on each criterion. Scores are then multiplied with the assigned weights to get an overall total.

According to Table 4 the two most feasible technologies that can be used to *verify home visits* are:

- Bar-coding
- GPS

4.1.1) Bar-coding as home visit verification technique

Bar-coding technology has advanced to such an extent that the camera on an entry level cell phone can perform the same function as a traditional laser barcode scanner. Heartbeat can make use of this technology by issuing each client's house / place of residence with a barcode of some sort. Childcare workers can then be monitored by scanning this barcode with their cell phones when they visit a child. The barcode in each child's house will uniquely identify that child. Scanning the unique barcode will serve as proof that the home visit to that specific child did indeed take place. Bar-code reading software comes standard with a whole range of Nokia phones and can be downloaded to a phone that does not have it.

If a web-based mobile system, such as Mobile Researcher, is used for reporting on home visits, bar-coding can easily be used in conjunction with that system. Mobile Researcher can request that a child's unique code must be entered; a CCW can then scan the barcode and attach the image in that field of the survey.

Bar-coding can also be used in conjunction with other technology such as USSD that can be used as data collection tool for home visit reporting. In this case an image of the barcode will be sent via MMS along with the USSD survey. The server will then store both the verification data (the barcode) and the other data collected via USSD. The verification data will then be run against the recorded barcodes on the database to verify that the specified child was indeed visited.

The advantages of bar-coding as verification method:

- Bar-coding is very user friendly, creating a unique bar-code is as easy as going onto the Nokia website. The website can assist you in creating bar-codes free of charge.
- Unlike a location based verification technique that might not be able to give an accurate location if the signal is poor, bar-codes will be effective regardless the signal strength.
- Photos taken with a cell phone camera are date and time stamped, so the same photo cannot be used to verify more than one visit.
- Most entry level cell phones have cameras, so CCWs can use their own phones if bar-coding technology is used as verification method.

The disadvantage of bar-coding as verification method:

- A photo of the barcode will need to be sent via MMS, this will be quite expensive (This is true in the case of a USSD system, not for a web-based service such as mobile researcher).
- Airtime will be required to send an MMS, if the CCW does not have airtime, the bar-code cannot be sent.

4.1.2) The use of GPS for home visit verification

The use of GPS (global positioning system) technology will definitely be one of the most effective solutions for the Heartbeat problem. GPS is extremely reliable and accurate in providing an exact location. It can be used in conjunction with any other mobile technology. Checking the location from which the assessment form was completed is the most obvious way to verify that a home visit took place. The GPS co-ordinates of all households on the Heartbeat database should be determined and when a visit assessment form from a particular household enters the system, one can immediately confirm whether the reported visit really took place by comparing the location from where the data was sent with the co-ordinates of the household.

The advantages of GPS in the heartbeat context:

- If a web-based service such as Mobile Researcher is used on a phone with GPS capabilities, the GPS co-ordinates of the location from which the application is run, is recorded. Mobile Researcher will automatically record the co-ordinates along with the date and time of completion.
- In this context GPS is hassle free, the verification of a home visit automatically takes place and a separate system for home visit verification does not need to be implemented.

The disadvantages of GPS in the heartbeat context:

- GPS technology is expensive. Although it has been on the market for quite a while now, only top of the range cell phones comes standard with an integrated GPS function. Apart from the capital expense of buying an expensive cell phone for each CCW, an expensive cell phone can put a CCW at risk for theft.

4.2) Analysis of mobile technology for reporting

The three technologies that can be used as *input mechanism for reporting on visits* that will be discussed are:

- Web-based mobile systems
- Interactive Voice Response (IVR)
- Unstructured Supplementary Service Data (USSD)

4.2.1) The use of a web-based mobile system:

Using a java application or any other web-based system for mobile phones will solve the problems Heartbeat is experiencing with home visit reporting. Just like an IVR system, a web-based service will eliminate the middleman (in this case the administrative officer and office personnel) between the CCW and the database. It will allow for data to flow directly from its source to the information system, where it will be processed and used for various reports and other decision making tools.

Web-based mobile systems have been used successfully in situations similar to that of the Heartbeat environment. A survey conducted by Health Care Workers using a web-based mobile system in a semi urban area of South Africa (refer to section 2.1.3.1) proved the technology to be a very feasible solution for similar problems.

The study referred to above collected information that would be very valuable in the Heartbeat context. Benefits include:

- It is possible to train people with very limited technological knowledge or experience to use such a system. (A training workshop for the health care workers took 2 days)
- The technology is suitable for entry level cell phones.
- It's a very secure system – during the study period of 4 months no data was lost.
- Data fabrication can be detected by comparing the time between surveys.
- It is easy for management to update or change the survey questions.
- Surveys can be completed without any cell phone signal. Unsent completed surveys are stored to the cell phone. An entry level phone can store up the 50 average sized surveys. As soon as a signal is found surveys will automatically be updated to the server.

The technology used in the study above is suitable for Heartbeat's purposes because:

- The application can run on entry level cell phones, this will reduce the risk of theft. CCW's work in areas with high crime rates; giving them expensive cell phones might make them ideal targets for muggings or theft.
- It can be used without any network connection. This is a valuable feature in the Heartbeat context because so many of the heartbeat children live in very rural areas with little or no cell phone reception.
- The digital solutions company (Clyral) that designed the Mobile Researcher (the application that was used in the study above) is based in South Africa, making it accessible to Heartbeat.

Further investigation on Mobile Researcher shows:

- Heartbeat will be charged 10 cents for every data field that is sent. If the visit assessment form that is currently used is converted to a questionnaire of 10 questions (data fields) it will cost R1 for every visit assessment form that is completed to be sent.
- If the cell phone on which Mobile Researcher is installed, has integrated GPS, the GPS co-ordinates of the location where the questionnaire is completed will be recorded with the data.
- Clyral can send the data gathered by their server to the Heartbeat office in Excel format, or an interface can be created that will send the data directly from the Clyral server to the Heartbeat database.

The disadvantage of Mobile Researcher:

- Cell phones need to have internet capabilities.
- 10 cents per data field is quite expensive.

4.2.2) Interactive Voice Response technology:

An Interactive Voice Response (IVR) system as data collection tool can be very effective in the Heartbeat context. If an IVR system is implemented by Heartbeat, a CCW will send a missed call to a specified number which will prompt a call to that CCW's cell phone. The CCW would be able to listen to the pre-recorded questions of the visit assessment form via their cell phones. The questions can then be answered by the CCW, by selecting an answer from a list, by pressing the corresponding button on their cell phone's keypad. The system will be operated by a computer which has the pre-recorded questions saved to it as voice files. When a call is made or received, the computer will play these voice files to the respondent. Answers to the questions received from respondents (in this case the CCW's) via touchtone key presses will be saved to the computer. If such an IVR system is used, it will completely computerise the home visit reporting system. This means that data collected

by the CCW's can be saved directly to a computer. This will eliminate a large percentage of human error.

The advantages of an IVR system in the Heartbeat setup:

- An IVR system can have multilingual interfaces. This might prove to be very helpful in the Heartbeat context, because CCW's all come from different backgrounds and levels of education. If CCW's are able to deliver data in their own home language, the quality of the data is bound to improve.
- Data corruption is minimized because of little human interference.
- No special features is necessary for a phone to use IVR, thus CCW can use their own phones.

The disadvantages of an IVR system in the Heartbeat setup:

- In order to receive a phone call from the computerized system, a CCW will need to make a missed call. If the CCW does not have airtime on his/her cell phone, he/she cannot make a missed call, and the questionnaire (the visit assessment form) can't be completed.
- The system can only operate in areas with cell phone network coverage. If a CCW's phone does not have signal, he/she cannot receive a call, thus the questionnaire (the visit assessment form) cannot be completed there and then. CCW will have to wait till later to complete the survey.
- An IVR system is expensive to implement and maintain. Because of the high cell phone rates in South Africa, voice calls are very expensive.

4.2.3) Unstructured Supplementary Service Data technology:

As discussed in the literature study, the use of USSD as a data collection tool is indeed very possible. In order to create a USSD service for Heartbeat a Wireless Application Service Provider (WASP) will be needed as well as a company that can host the server. The Meraka Institute at the CSIR has a mobile platform called Mobi4d that will be able to host the server and create/manage the USSD application. A design team will create a survey with a menu structure unique to Heartbeat's requirements. A CCW will be able to access the USSD service by dialling a number that will be specified by the WASP. Once the CCW has accessed the service and completed the survey, the data will be routed via the WASP to the server, where it will be saved. The saved data can then be used to update the Heartbeat database. This system will be easy to use and will enable the database to be continuously updated without any human assistance other than the CCWs.

The advantages of an USSD system in the Heartbeat setup:

- As with IVR, a USSD system can have multilingual interfaces. This might prove to be very helpful in the Heartbeat context, because CCW's all come from different

backgrounds and levels of education. If CCW's are able to deliver data in their own home language, the quality of the data is bound to improve.

- The USSD service will be easy to access (CCW simply needs to dial a number)
- The USSD service will be easy to use (A very simple menu structure can be used)
- Any phone can use USSD technology, thus CCW can use the phones they currently have regardless of the model or make.
- Data corruption is minimized because of little human interference.

The disadvantages of an USSD system in the Heartbeat setup:

- In order to access the USSD service, a CCW will need to have airtime on his/her cell phone, if he/she does not have airtime the questionnaire/survey can't be completed.
- The system can only operate in areas with cell phone network coverage. If a CCW's phone does not have signal, he/she cannot receive a call, thus the questionnaire/survey cannot be completed.
- The connection to the USSD service is disabled after 3 minutes. If a survey was not completed in that time, the data will be lost and the CCW would have to start the process again.
- A USSD system is expensive to implement and maintain. Although USSD is cheaper than voice calls and SMS, you pay for the amount of time you use the application. In the case study conducted in a home based care environment in Mpumalanga, referred to in section 2.1.2. a typical survey took approximately 1 and a half minutes to complete, and at the rate of 20cents/20Seconds it cost them approximately R1,20 per survey completed. Because one cannot control how long a CCW will take to complete a survey, it could become expensive.

Chapter 5
The BPR Process

In this section Business Process Reengineering (BPR) principles as discussed in the literature study in chapter 2 will be used to improve the current system used by CCW's to report on home visits. By using these BPR principles the objectives set out in the first chapter namely to:

1. optimize home visits
2. find a suitable verification technology
3. find a suitable technology to replace the Visit Assessment Form
4. train CCW's to use the new system and to
5. enable effective reporting

should be met.

5.1) Prepare for reengineering

5.1.1) The need for change:

In order to start the reengineering process it is necessary to determine why the changes that are being planned for the Heartbeat home visit reporting system are needed. The following reasons where identified:

- Home visits aren't currently utilised to their full capacity
- Home visits aren't made as regularly as they should be
- Home visits aren't reported on
- The database is not up to date
- Reporting to stakeholders and management aren't as complete as they could be

5.1.2) Customer expectations:

In this first phase of the BPR process it is important to understand what the beneficiaries' (children enrolled in the Heartbeat program) expectations/requirements are with regards to the services that are being delivered to them and to determine where the current process falls short of these expectations. In Figure 3 below the problems experienced with home visits (from the perspective of the heartbeat beneficiaries) are mapped out in a fishbone diagram.

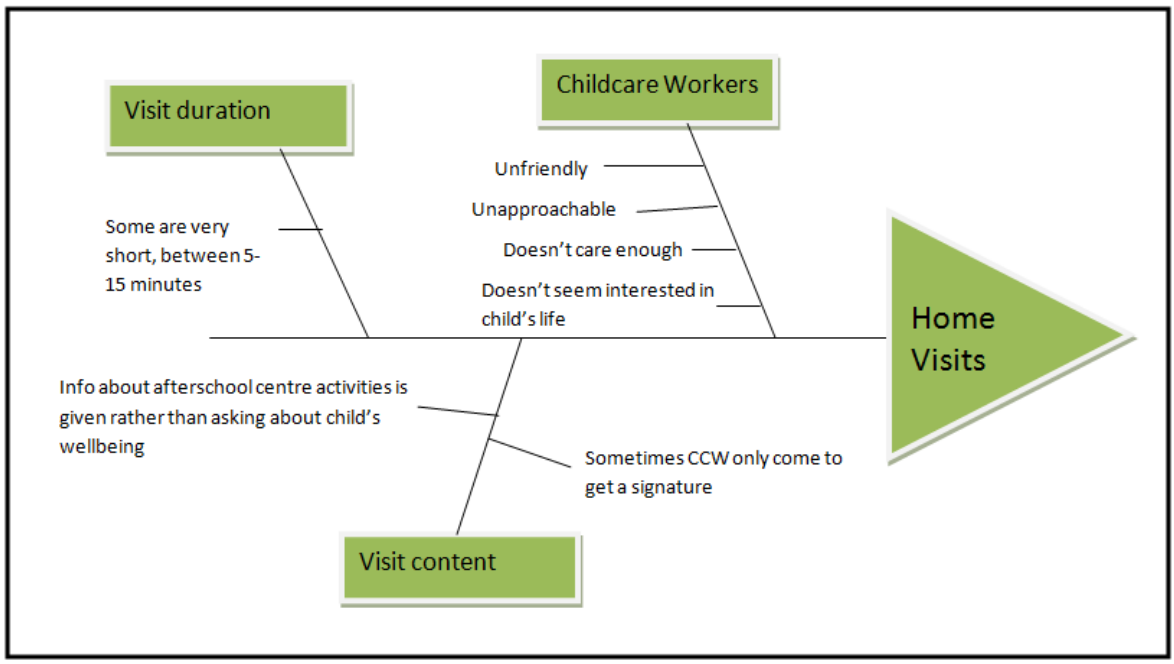


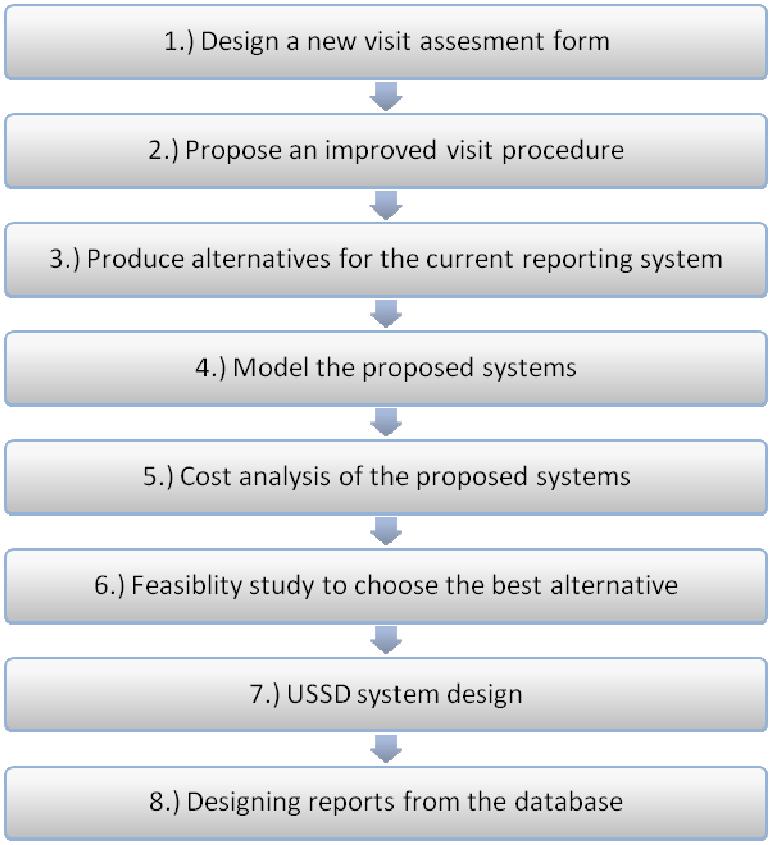
Figure 10: Fishbone diagram of the problems experienced with home visits - from the perspective of the heartbeat beneficiaries

5.2) Map and analyse As-Is

This aspect of the BPR process is already accounted for in Chapter 3.

5.3) Design To-Be process

In this phase of the BPR process the following steps will be followed to reach a newly designed To-Be process:



5.3.1) Designing a new visit assessment form:

A new visit assessment form should be designed to replace the one currently used (Figure 9) to report on home visits. The new form should address all the aspects that was found lacking in the current form (refer to section 3.1.3). The focus of the new form should be to gather information regarding the child's physical and emotional wellbeing. The new form should also assist the CCW to cover the content that is prescribed by Heartbeat management (refer to section 3.1.4). The design of a new form is proposed hereafter:

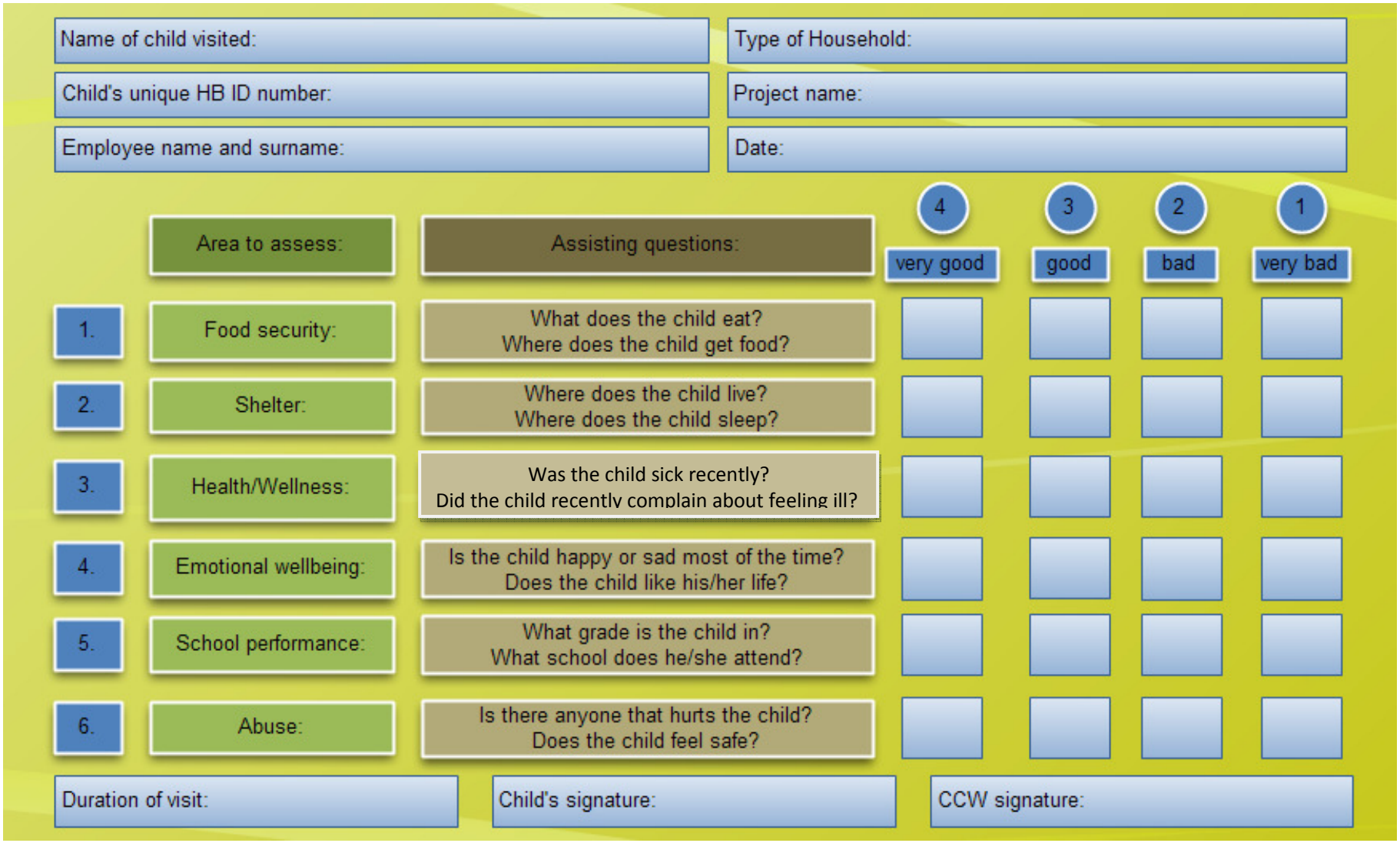


Figure 11: Proposed new visit assessment form

5.3.2) Improving the visit procedure:

A new procedure should be established for home visits, which will assist CCW to get the correct information from the visit. A proposed new procedure follows in Table 5.

When visiting a child a CCW should:
• **Greet the child in a friendly manner;**
• **Ask about the child's day/week;**
• **Follow the questions on the new visit assessment form;**
• **Complete the new visit assessment form (via mobile technology);**
• **Ask if the child has anything else he/she wants to share;**
• **Provide information about upcoming events at the After School Centre.**

Table 5: Proposed home visit procedure

5.3.3) Produce alternatives that will satisfy the objectives:

The mobile technology systems analysed in chapter 4 will be assessed for possible use in the To-Be process. It has recently been decided that giving CCW's new phones would not be a good idea. The phones will not belong to them so there won't be a sense of ownership to take care of the phones. Giving CCWs new phones can also make them a target for crime; new phones are more likely to be stolen than old ones. This consideration is very important when looking at the alternatives laid out in chapter 4. Having to choose a technology that can be used on the CCW's own cell phones will rule out the option of a web-based service, because not all CCW's phones have internet capabilities. It also excludes GPS as a viable option, because GPS enabled phones will be required. This leaves the other two options namely IVR and USSD as possible input mechanisms for reporting and bar-code technology as the verification method to be used.

The proposed systems will work in the following way:

USSD system:

- A survey will be created comprising of a few targeted questions, designed to capture the most important information gathered during a home visit. A menu structure will be used that will guide the user through the questionnaire on a step by step basis.
- A Wireless Application Service Provider (WASP) will host the USSD service, the WASP will enable access to the USSD service from all mobile networks.

- Childcare Workers (CCWs) will access the USSD service by dialling a number that the WASP will provide. This number usually consists of 3 or 4 digits and is followed by a # key.
- Once the USSD service is accessed a menu will appear and the CCW can complete the survey by following the instructions on the screen.
- Data that is gathered via the USSD service will be sent via the WASP to a back end server. Data will be stored on this server.
- The data from the server can then be used to update the Heartbeat database.

Verification method with the USSD system:

- Bar-coding technology will be used in conjunction with the USSD technology. A photo of a bar-code unique to the child's house will be taken and sent via MMS along with the USSD survey. The server will then store both the verification data (the barcode) and the other data collected via USSD. The verification data will then be run against the recorded barcodes on the database to verify that the specified child was indeed visited.

IVR system:

- Using a similar menu structure to that used in an USSD service
- A service provider that will create a customized IVR system for Heartbeat will host the service.
- In the implementation phase of such a project all of the CCW's cell phone numbers will be registered to a server. Only the registered users will have access to the service.
- CCWs will access the IVR service by giving the service provider a missed call.
- This call will trigger the server to which all of the CCW's cell numbers are saved to call the CCW back (only if the person who called is a registered user).
- The CCW will take the call and complete the survey following the voice prompts.
- An extra feature that will enable CCWs to leave an additional comment can also be built into the system. This means that if a CCW picked up on a problem during a home visit that they think requires immediate attention, they can leave a voice message on the IVR service.
- Once the call is completed, all data gathered from CCWs including the additional comments, will be saved to the server, the additional comments will be saved as voice files.
- The saved data will be used to update the Heartbeat database.
- The voice files will be sent to the Heartbeat office where they will be captured by office staff.

Verification method with the IVR service:

- As part of the IVR system bar-code technology can also be used for verification.
- After completing the survey via IVR, the system can give the CCW a unique number.
- By sending this unique number along with an image of the barcode, the particular IVR survey can be linked to a child's unique barcode, this will verify the visit.

5.3.4) Modelling the To-Be process:

For a more in depth understanding of how the proposed system works, as well as to ensure that they meet design requirements, different modelling techniques are used to scope the To-Be processes.

The use case diagrams in figure 9 and 10 shows all the actors involved in the proposed To-Be process as well as the tasks that will be performed.

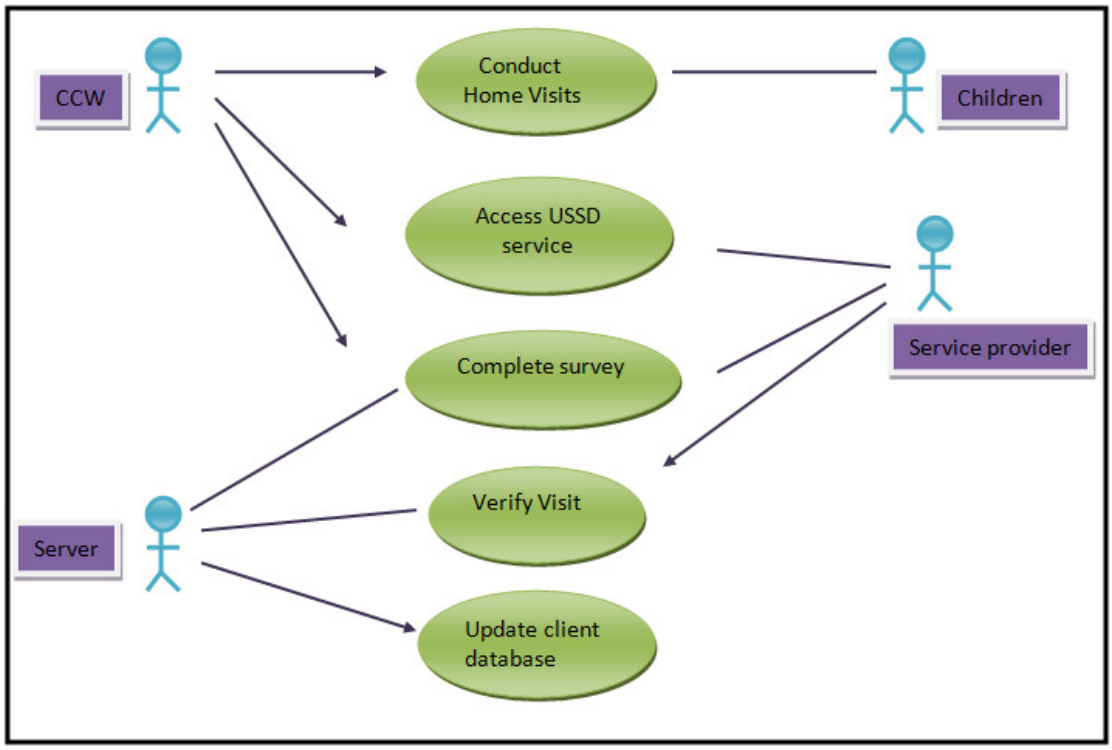


Figure 12: Use-case model of USSD system

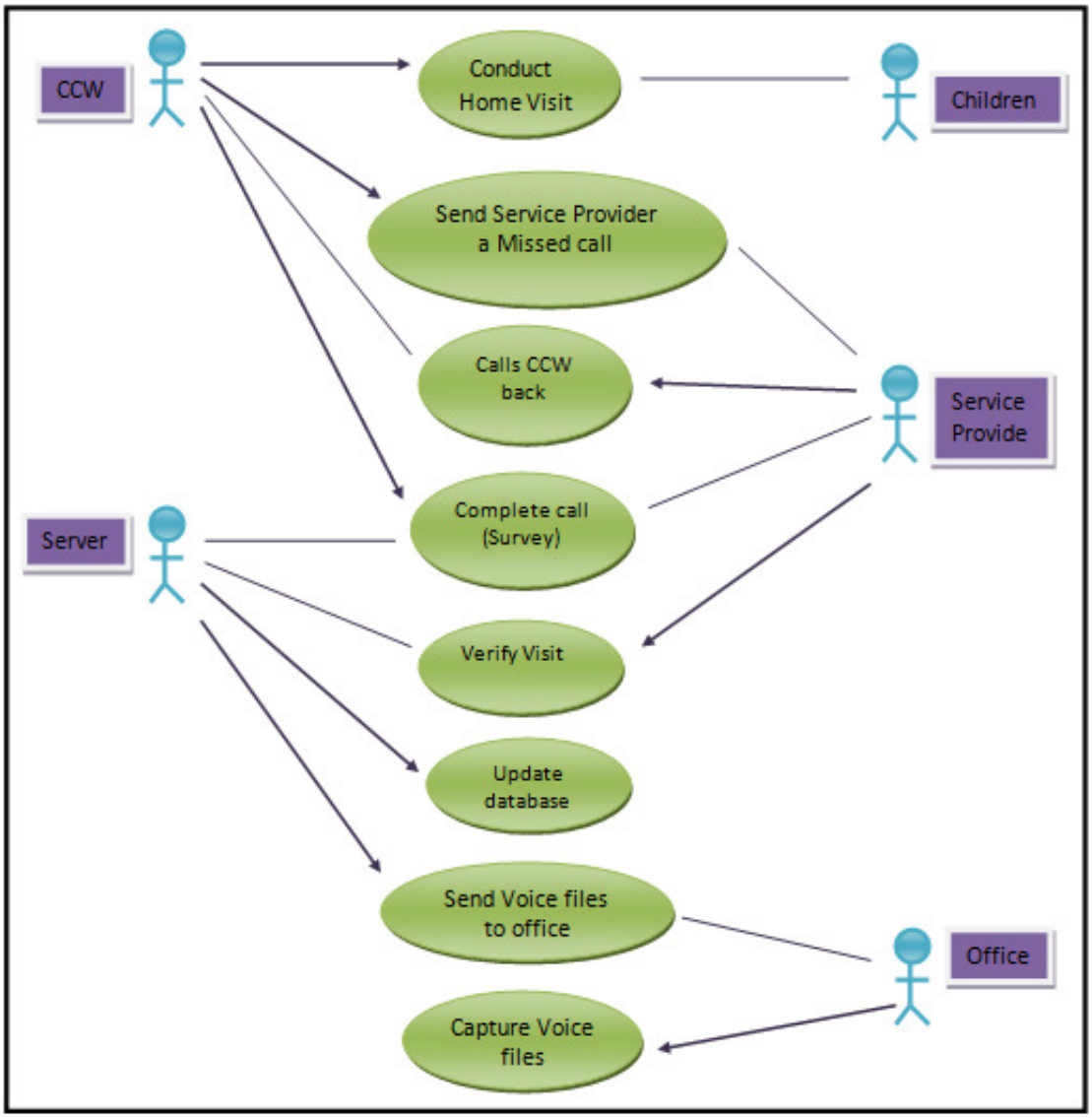


Figure 13: Use-case model of IVR system

To detail the use-case models above, activity diagrams of both the proposed systems are shown in Figure 14 and Figure 15 below:

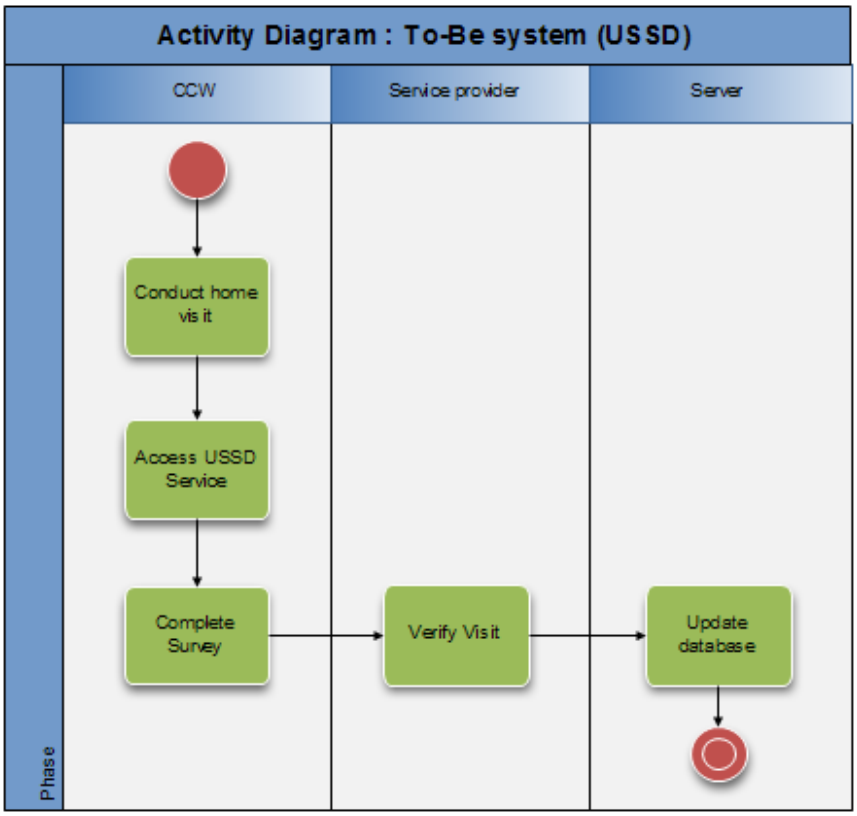


Figure 14: Activity diagram of USSD system

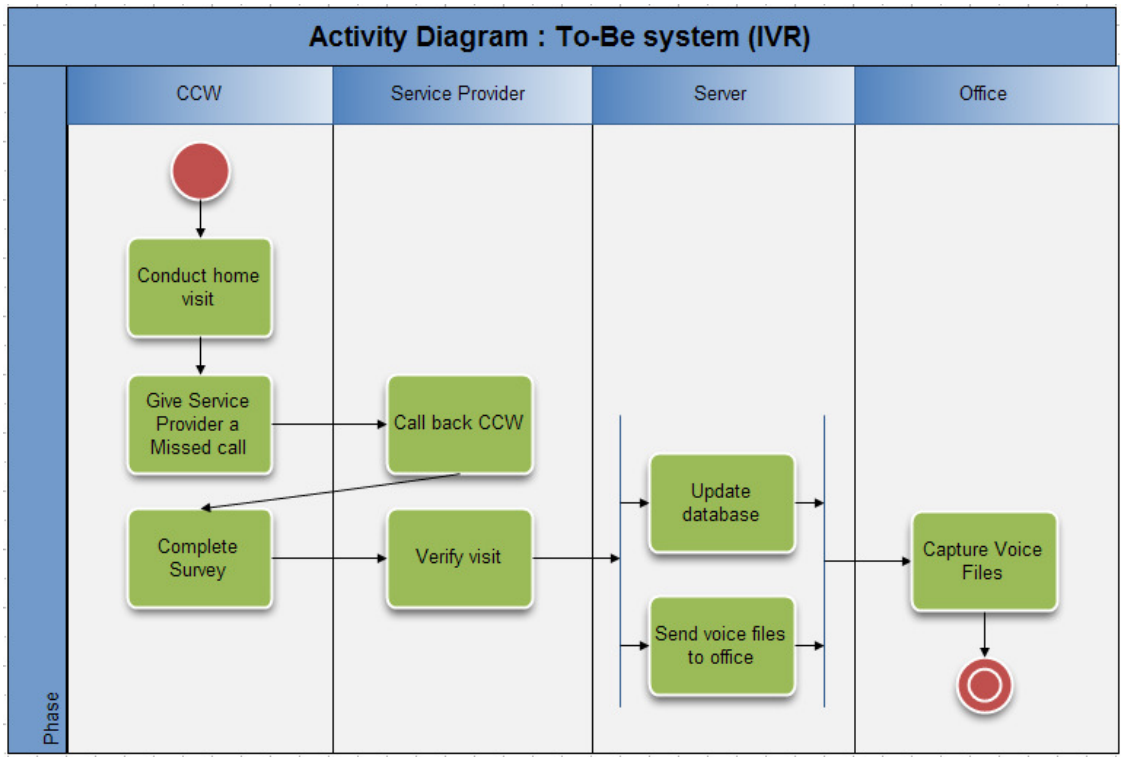


Figure 15: Activity diagram of IVR system

A data flow diagram indicating how data flows between external agents, processes and data stores in the proposed systems is shown in Figure 16 and Figure 17.

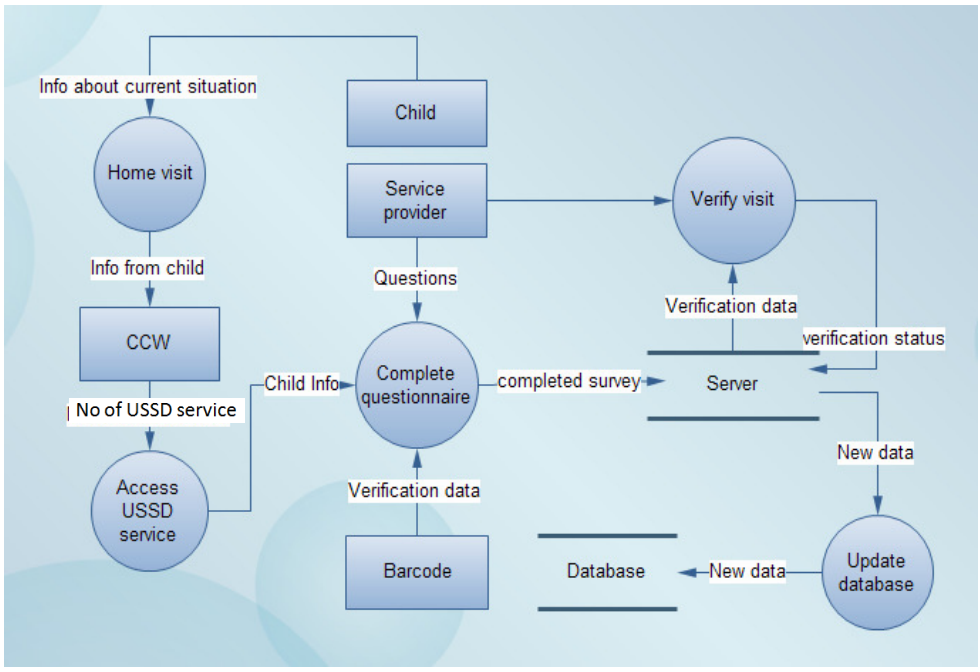


Figure 16: Data Flow Diagram of USSD system

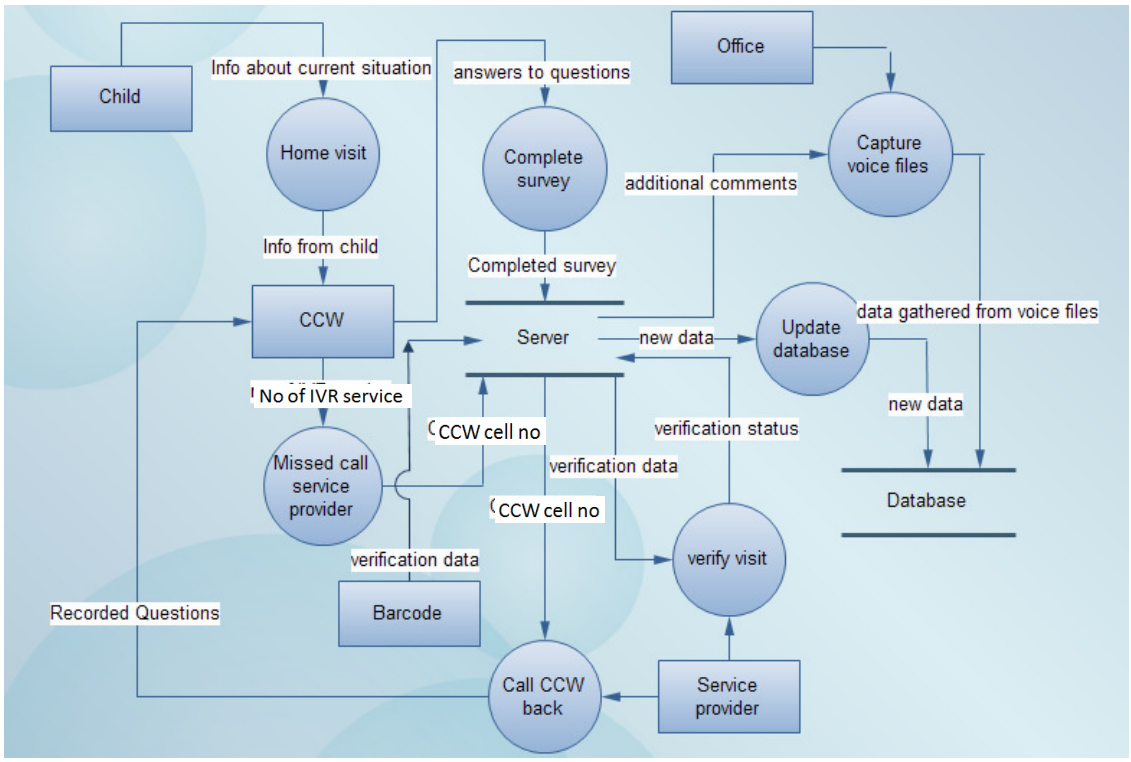


Figure 17: Data Flow Diagram of IVR system

To further illustrate the proposed system an IDEF0 model of both alternatives was created:

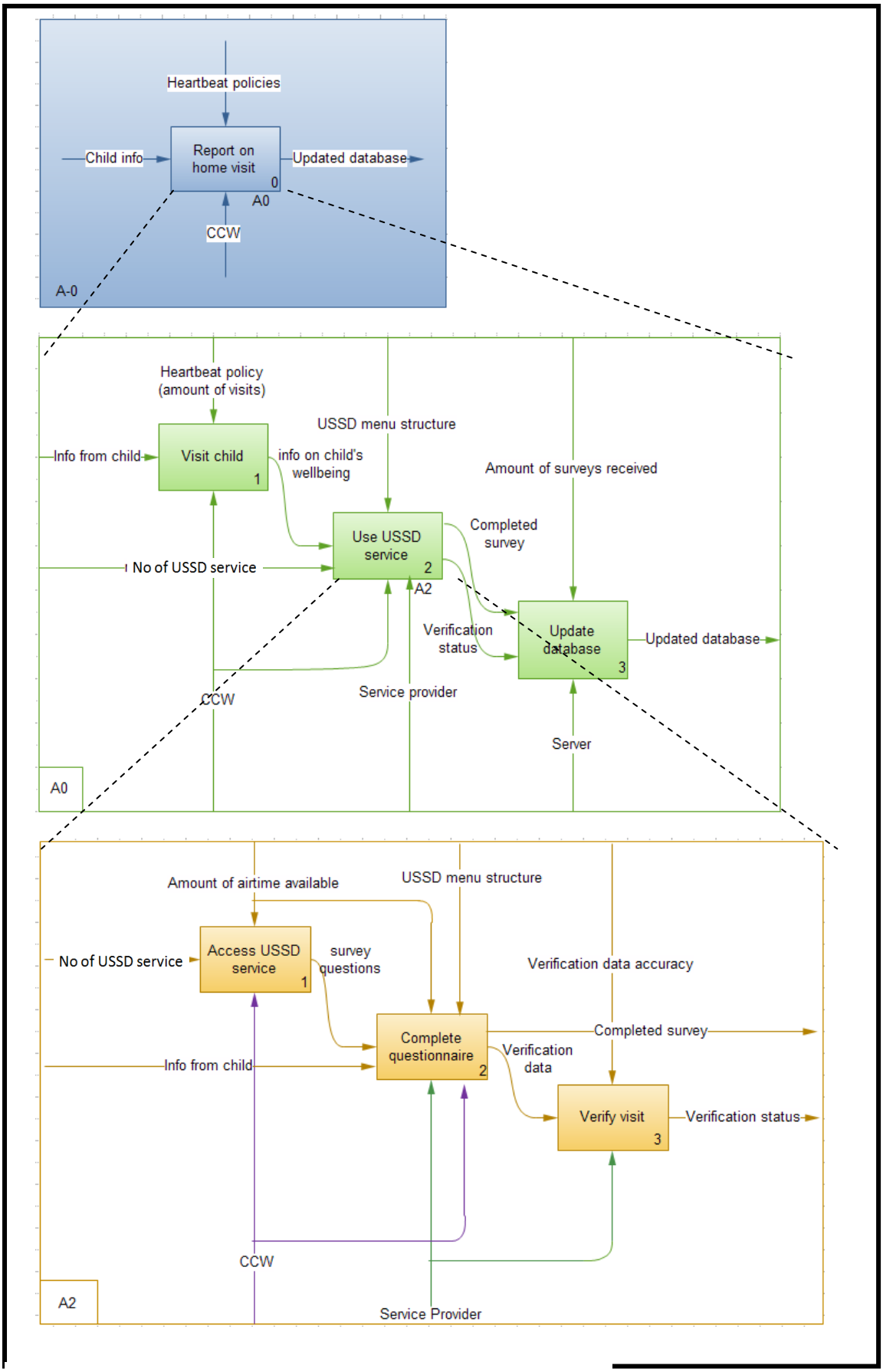


Figure 18: IDEF0 model of USSD system

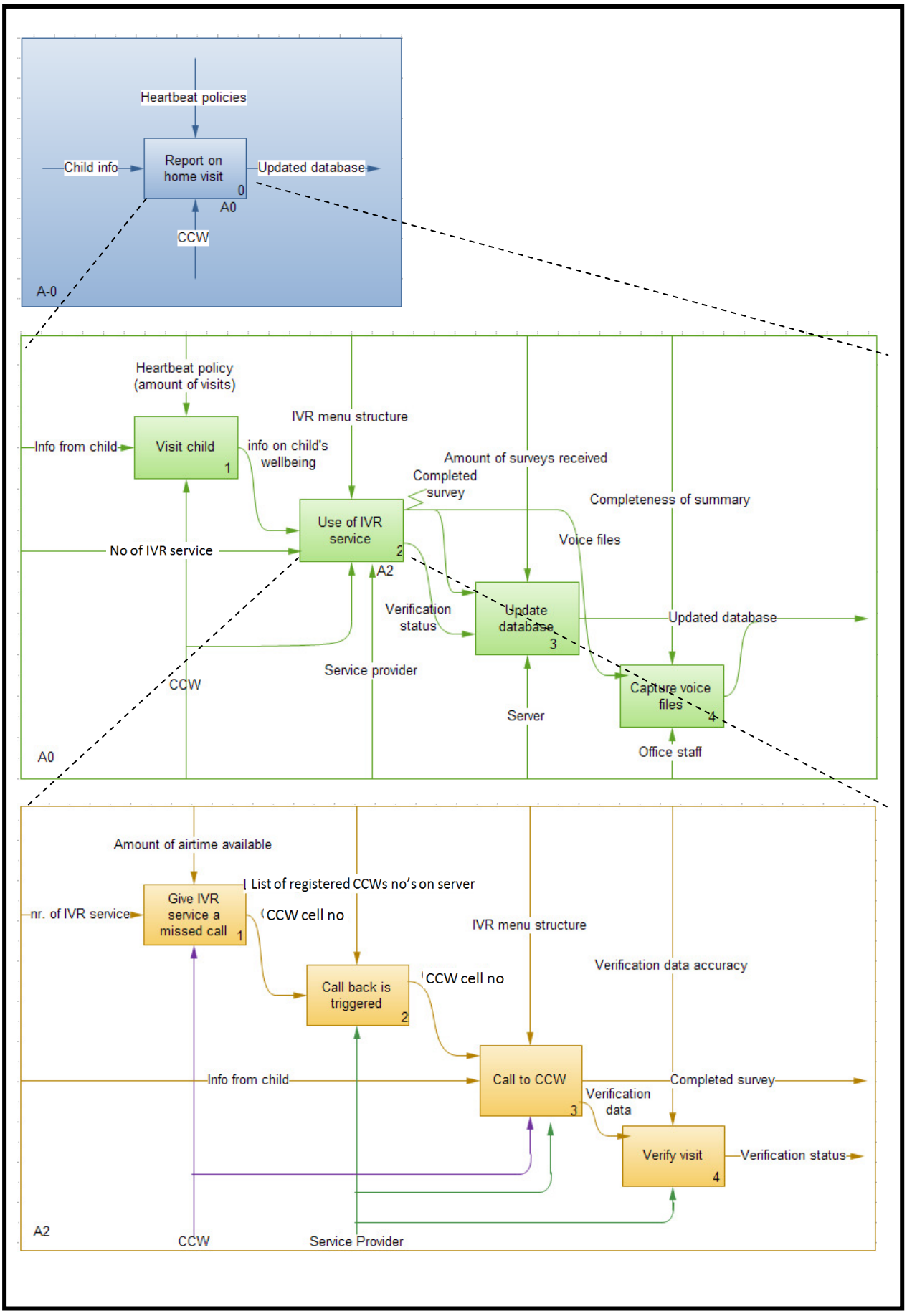


Figure 19: IDEF0 model of IVR system

5.3.5) Cost analysis of alternatives:

Before one can analyse the costs, it should be determined how many home visits will take place in an average month. This will determine the amount of surveys that will need to be completed, which will determine the running cost of the systems. The amount of visits made by CCWs is calculated in Table 6 below:

Type of Household	Number of children in category	Required visits per week	Required visits in an average month	Amount of visits for the category
CCH	800	3	12	9600
RHH	3683	1	4	14732
POH	458	1	4	1832
Totals	4941			**26164**

Table 6: The amount of visits made by CCWs

A Cost analysis of each alternative is shown in the following tables:

Cost of developing a USSD system for Heartbeat			
	Rates	**Period**	**Totals**
1 Design			
Human Resources			
Application Design Team (2 members)	R320 p.day	30 days	19200
Technicians (4 members)	R180 p.day	30 days	21600
2 Back-end Processing			21300
3 Pilot testing			
Surveys from users (50 surveys)	R1,20 per survey		60
MMS for verification	R1,80 per MMS		90
Subsistence and Travel			5000
Totals			**67250**
Monthly running costs of a USSD system for Heartbeat			
	Rates	**Period**	**Totals**
Surveys from users (26000 surveys)	R1,20 per survey		31200
MMS for verification (26000)	R1,80 per MMS		46800
Totals			**78000**

Table 7: Cost analysis of USSD system

Cost of developing an IVR system for Heartbeat			
	Rates	**Period**	**Totals**
1 Design			
Human Resources			
Application Design Team (2 members)	R320 p.day	40 days	25600
Technicians -Develop platform	R180 p.day	40 days	7200
-TTS (text to speech)	R180 p.day	40 days	7200
-ASR (voice recognition)	R180 p.day	40 days	7200
Dialogue recording			
Studio (6 hours)	R3000 p.hour	6 hours	18000
Voice Artist (6 hours)	R3000 p.hour	6 hours	18000
2 Pilot testing			
Calls from users (50 calls)	R1,475 p.min	2 minutes	147,5
MMS for verification	R1,80 p.MMS		90
Telephone line hire from Telkom:			
-installation			491
-indoor transfer			412,68
-monthly rental (1month)	R182,7 p.month	1 month	182,7
Subsistence and Travel			5000
Totals			**89523,88**

Monthly running costs of an IVR system for Heartbeat			
	Rates	**Period**	**Totals**
Surveys from users (26000 surveys)	R2,95 per survey		76700
MMS for verification (26000)	R1,80 per MMS		46800
Totals			**123500**

Table 8: Cost analysis of IVR system

5.3.6) Feasibility analysis

A Feasibility analysis matrix is used to determine which of the two proposed systems is the best alternative. The matrix is drawn using the concept of value engineering discussed in section 2.2.5. Weights were assigned to criteria based on the importance of each criterion to the Heartbeat management.

Criteria	Weight	USSD	IVR
Economic Feasibility (A): ***The costs that heartbeat would incur in the development phase.***	**20%**	**70%** System development costs +- R 70 000	**50%** System development costs +- R 90 000
Economic Feasibility (B): ***The running cost of the system***	**45%**	**60%** Running costs + - R 80 000	**30%** Running costs + - R 125 000
Technical Feasibility: ***How difficult/easy will the system be to implement***	**10%**	**70%** Fairly easy	**70%** Fairly easy
Operational Feasibility: ***How difficult/easy will it be for CCW to use the system***	**25%**	**60%** CCW must go to some trouble to read questions and type answers	**80%** CCW only has to listen to voice prompts and press keys
Totals		**63%**	**51%**

Table 9: Feasibility Analysis Matrix

When all criteria and their importance to management are taken into account, the USSD system seems to be the most feasible option.

5.3.7) USSD system design:

As a USSD system is the most feasible alternative, a possible design for the proposed USSD system is illustrated in Figure 20 and Figure 21 (following on page 46 and 47). This design takes into account the assessment areas identified in the new visit assessment form in Figure 11. It guides the CCW through the USSD survey in a step by step manner:

Step 1: The CCW can select the language in which he/she prefers to complete the survey.

Step 2: The CCW is asked to insert the child's Heartbeat code. This will uniquely identify the child

Step 3 and 4: A screen appears that list all the sections that the CCW needs to complete. This can be referred to as the home screen. To select a section the CCW will press the

corresponding number on the cell phone's keypad. After completing a section, the home screen will appear again. The process will continue until all sections are answered.

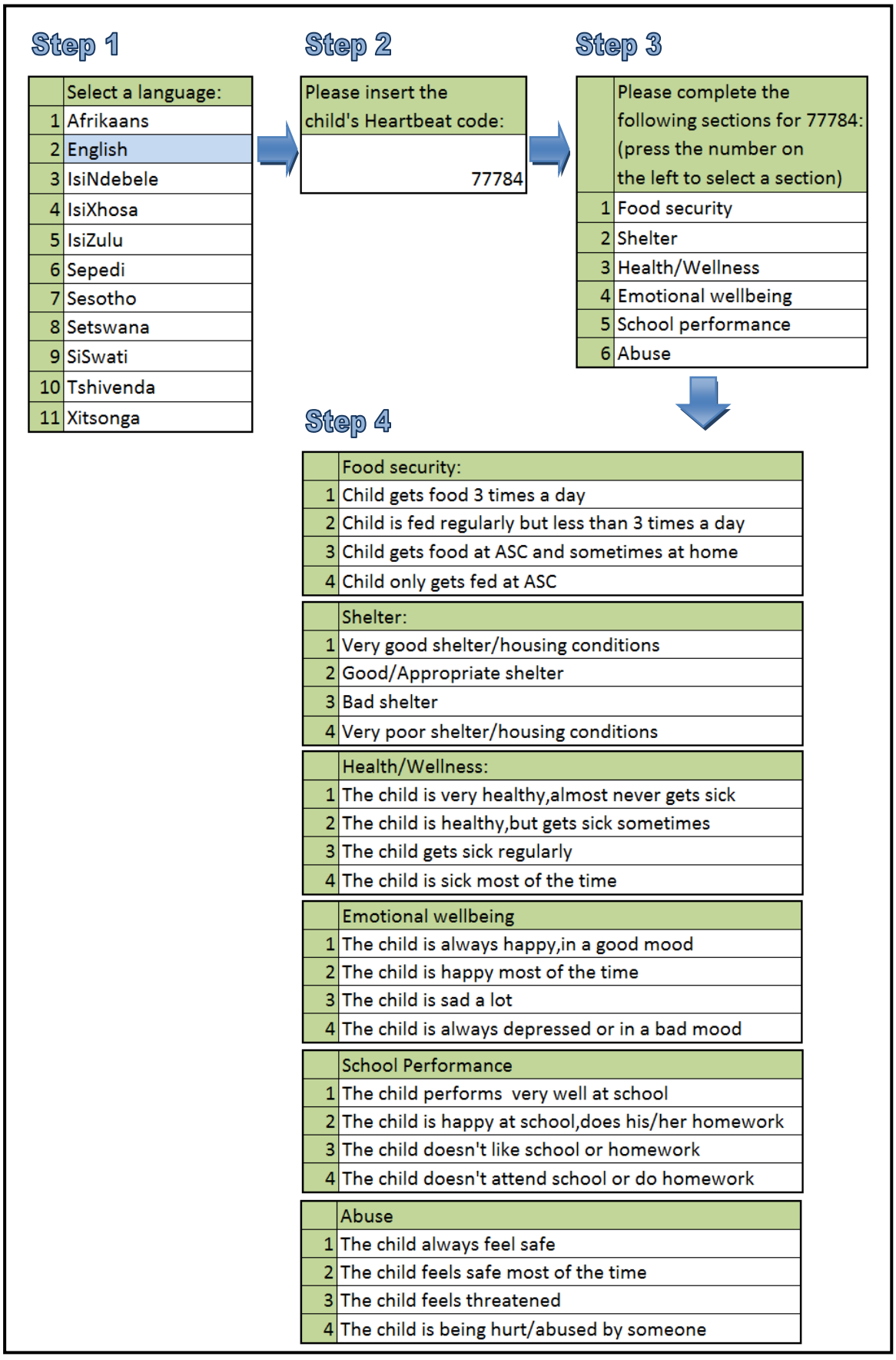


Figure 20: USSD system design (step1-4)

Step 5: The CCW will be given the option to submit the survey or to return to the home screen to make changes.

Step 6: The CCW will be reminded to send an MMS of the child's bar-code.

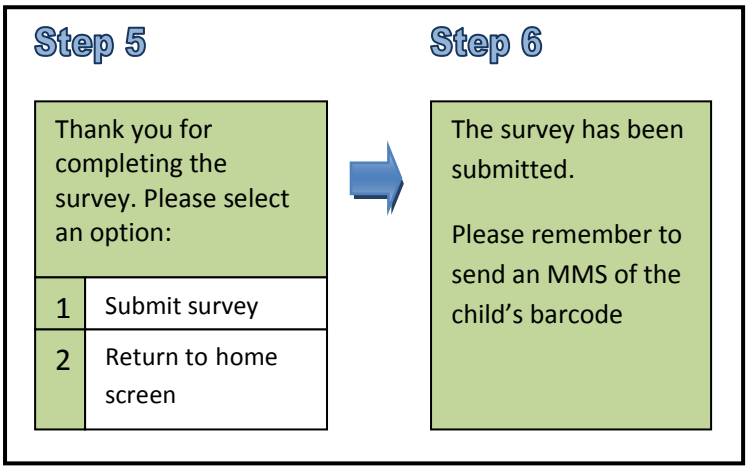


Figure 21: USSD system design (step 5-6)

5.3.8) Designing reports from the database:

Should the proposed USSD system be implemented, the Heartbeat database will be in a continuous updated state. This will enable management to get up to date reports at any given date or time. Various different reports can be created from the data that will be collected from the proposed USSD system.

Types of reports that can be created:
(These are only a few suggestions, several other possibilities exist)

- A report to external stakeholders and government on how many children are served by Heartbeat in a given timeframe
- A report to SACIN donors on the general wellbeing of the child they sponsor at any time or date
- A report to management on how many visits to children are made by each CCW during a time period
- A report to management to compare the different sites with each other based on the amount of visits made to children
- A report to management that can give an updated account (full history) of each child's response to the home visit survey.

Possible report designs:

1. In Figure 22 an example of a possible report design is shown. This particular report allows management to compare the number of visits made to children by each CCW during a specific period. The data is sorted in terms of the different sites.
   This particular report will allow management to closely monitor CCWs performance. It can also be used as a tool for workload assignment; CCWs who made fewer visits during a specific period of time can potentially take on more children. Because this report counts the amount of visits made and not the number of children that gets visited, workload can be distributed more evenly. In the current system CCWs is assigned 10-15 households, irrespective of the type of household. Because Child Headed Households (CHH) requires more visits than Relative Headed Households (RHH) and Potentially Orphaned Households (POH), some CCWs are required to make much more visits than others. This report will point to any irregularities in workload distribution and/or job performance.

2. Figure 23 shows an example of a report for management that gives an up to date history of the data recorded at home visits. The data is sorted by children and can be filtered by indicating a specific CCW and time period. All data captured during home visits are displayed as well as the type of household (ToH) the child belongs to. The number of visits the child received (total visits) as well as the number of visits the child was supposed to receive (required visits) is indicated. This report is useful if

management wants to take a closer look at a specific CCWs performance for example how frequently he/she visits what children, as well as the amount of visits he/she did make against the amount of visits he/she was supposed to make. A performance % (Total visits / Required visits) is given to the CCW.
The report can also be used to monitor the wellbeing of specific children by comparing the data captured at different visits.

3. Figure 24 gives an example of a report that compares different sites with each other based on the performance of CCWs. A performance % (Total visits / Required visits) is given to each site to give management a quick high level overview of state of affairs at each site. The number of required visits is calculated by multiplying each type of household with the amount of visits that should be received by a child in such a household. For example a child in a Child Headed Household (CHH) should be visited 3 times per week, which would mean 12 visits in an average month.

4. Figure 25 is an example of a report that can be given to SACIN donors. This will give a donor a full report of what was captured at each visit to the child. The information can be useful to a donor in various ways, for example when the score under the "food security" column is continually high it would indicate that the child doesn't get enough food. The donor can then make a specific contribution towards food. If the "health/wellness" column indicated a high score, the donor could possibly pay for the child's doctor appointment and/or other medical costs. This targeted approach will result in better service delivery to the children.

Botshabelo

January 2010

Total visits: 300

Required visits: 920

CCH: 10

RHH: 100

POH: 100

CCW: Abrahams, Denise

Total visits: 4 | Required visits: 32 | CCH: 2 | RHH: 2 | POH: 0

Child's Heartbeat ID	Child's name	Date of visit
114455	Andrews, Mike	05/01/2010
124678	Brandon, Samson	06/01/2010
568100	Messer, Joey	08/01/2010
336789	Crises, Jack	18/01/2010

CCW: Clarke, Amanda

Total visits: 3 | Required visits: 12 | CCH: 0 | RHH: 1 | POH: 2

Child's Heartbeat ID	Child's name	Date of visit
114789	Dean, John	05/01/2010
346632	Earl, Samantha	07/01/2010
908421	Franc, Matthew	12/01/2010

CCW: Edwards, Melissa

Total visits: 5 | Required visits: 44 | CCH: 3 | RHH: 1 | POH: 1

Child's Heartbeat ID	Child's name	Date of visit
222256	Grant, Shelley	07/01/2010
456712	Hanson, Felicia	09/01/2010
345682	Jackson, Edward	16/01/2010
234566	King, Gloria	18/01/2010
399876	Lambert, George	23/01/2010

CCW: Fourier, Nicolas

Total visits: 2 | Required visits: 8 | CCH: 0 | RHH: 2 | POH: 0

Child's Heartbeat ID	Child's name	Date of visit
679011	Mitchell, Them	09/01/2010
124865	Paulson, Stephan	15/01/2010

Figure 22: Example of a report for management to compare job performance and workload

CCW: Abrahams, Denise

Period: January 2010

Performance % (Total visits / Required visits) = 78,6%

Number of children: 3

Total visits: 22

Required visits: 28

Child: Andrews, Mike

Site: Nellmapius | **ToH :** RRH | **Total visits:** 4 | **Required visits:** 4

Date of visit	Time of visit	Food	Shelter	Health	Emotional	School	Abuse
05/01/2010	15:00	1	3	4	4	1	1
12/01/2010	16:05	1	3	2	2	1	1
19/01/2010	15:30	2	2	1	2	1	1
26/01/2010	14:45	1	2	1	1	2	2

Child: Dean, John

Site: Nellmapius | **ToH:** CHH | **Total visits:** 11 | **Required visits:** 12

Date of visit	Time of visit	Food	Shelter	Health	Emotional	School	Abuse
05/01/2010	15:00	1	3	4	4	1	1
07/01/2010	15:00	1	1	1	3	1	1
09/01/2010	15:00	2	2	2	2	2	1
12/01/2010	16:05	1	3	2	2	1	1
15/01/2010	16:00	2	3	3	3	1	1
19/01/2010	15:30	2	2	1	2	1	1
21/01/2010	15:00	2	1	1	1	2	2
23/01/2010	16:15	1	2	3	1	2	3
26/01/2010	14:45	1	2	1	1	2	2
28/01/2010	15:00	1	2	4	3	2	1
30/01/2010	15:00	2	2	2	2	1	1

Child: Grant, Shelley

Site: Nellmapius | **ToH:** CHH | **Total visits:** 7 | **Required visits:** 12

Date of visit	Time of visit	Food	Shelter	Health	Emotional	School	Abuse
05/01/2010	15:00	1	3	4	4	1	1
07/01/2010	15:00	1	1	1	3	1	1
09/01/2010	15:00	2	2	2	2	2	1
12/01/2010	16:05	1	3	2	2	1	1
15/01/2010	16:00	2	3	3	3	1	1
19/01/2010	15:30	2	2	1	2	1	1
21/01/2010	15:00	2	1	1	1	2	2

Figure 23: Example of a report that gives a full account of all children served by a CCW

All Sites

January 2010

Number of children: 4941

Required visits: 26164

Total visits: 15000

CCH: 800

RHH: 3683

POH: 458

Performance % (Total visits / Required visits) = 57,3%

Site: Atteridgeville — **Performance %** = 64,7

Number of children	800
Required visits	4640
Total visits	3000
Number of children in CHH	180
Number of children in RHH	520
Number of children in POH	100

Site: Botshabelo — **Performance %** = 75

Number of children	300
Required visits	2000
Total visits	1500
Number of children in CHH	100
Number of children in RHH	100
Number of children in POH	100

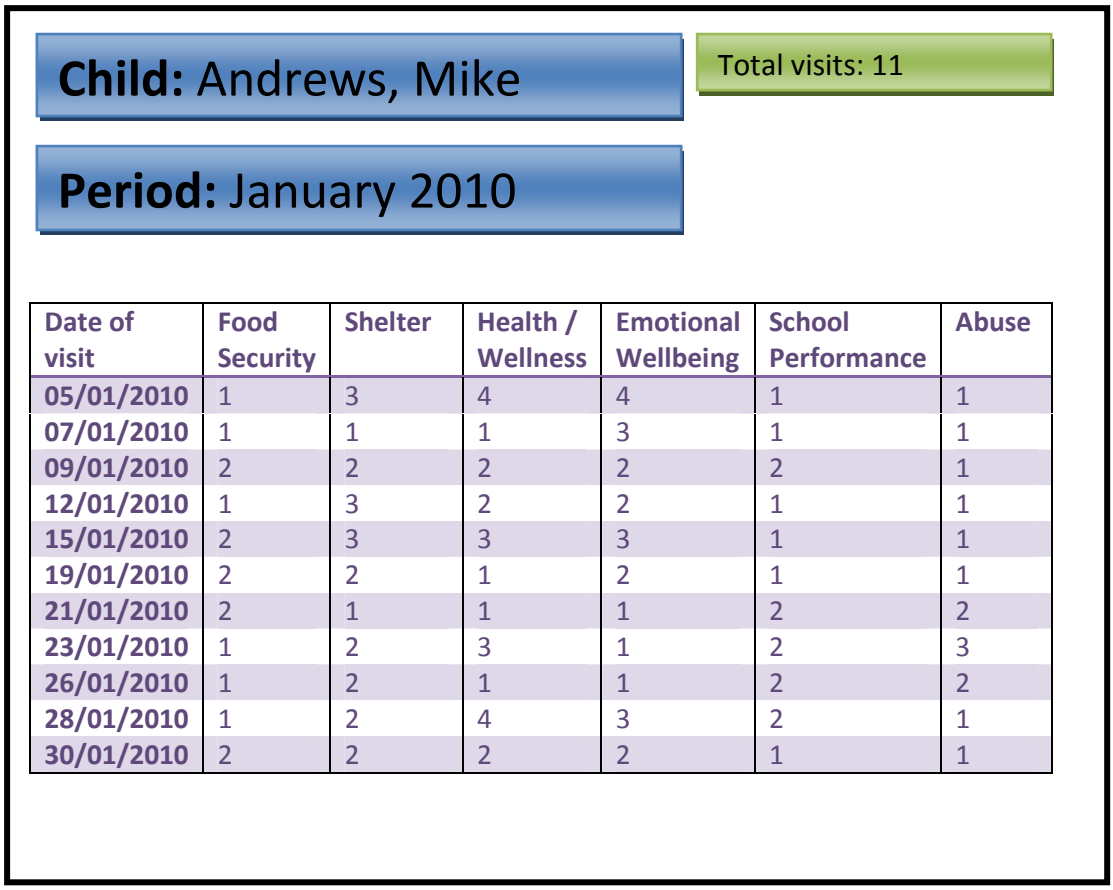
Site: Emthonjeni — **Performance %** = 80

Number of children	500
Required visits	3600
Total visits	2888
Number of children in CHH	200
Number of children in RHH	200
Number of children in POH	100

Site: Katlehong — **Performance %** = 57

Number of children	1000
Required visits	5600
Total visits	3200
Number of children in CHH	200
Number of children in RHH	500
Number of children in POH	300

Figure 24: Example of a report that compares the performance of different sites



Date of visit	Food Security	Shelter	Health / Wellness	Emotional Wellbeing	School Performance	Abuse
05/01/2010	1	3	4	4	1	1
07/01/2010	1	1	1	3	1	1
09/01/2010	2	2	2	2	2	1
12/01/2010	1	3	2	2	1	1
15/01/2010	2	3	3	3	1	1
19/01/2010	2	2	1	2	1	1
21/01/2010	2	1	1	1	2	2
23/01/2010	1	2	3	1	2	3
26/01/2010	1	2	1	1	2	2
28/01/2010	1	2	4	3	2	1
30/01/2010	2	2	2	2	1	1

Figure 25: Example of a report for SACIN donors

5.4) Implement Reengineered Process

5.4.1) Develop a transition plan from As-Is to To-Be

In order to switch from the current system to the new USSD system certain tasks must be defined. The implementation plan shown below indicates what tasks need to be performed and who will be responsible for them:

Task (what?)	Person Responsible (who?)	Output/Deliverable	Completion date (when?)
Use suggested menu structure for the USSD system to build the system	Design / technical team	A functional system	15 October 2010
Test the USSD system	Design / technical team	An operational USSD service	18 October 2010
Create interface with Heartbeat database	Technical team	Data can be sent from the USSD system to the Heartbeat database	22 October 2010
Adapt Heartbeat database to the new system requirements	Heartbeat	Database is ready to receive data from the new system	22 October 2010
Test to ensure that data can be received by the database	Design / technical team	A working interface between the server and the Heartbeat database	25 October 2010
Create unique bar-codes for all children enrolled in the program	Technical team	A verification method	5 November
Create reports that can be generated from the updated database	Me	Reports to management and external stakeholders	5 November 2010
Create more extensive training material	Me and Heartbeat personnel	Training material for users	12 November 2010
Pilot test system	Technical team and Heartbeat official	An operational system	12 November 2010
Refine the system	Technical team and Heartbeat official	A fully tested and refined operational system	19 November 2010
Train users	Me	CCWs will know how to use the system	3 December 2010

Table 10: Implementation plan

5.4.2) Test the system

The proposed USSD system will be tested in the following three phases (phases are highlighted in Table 10):

1. After the initial design and development of a USSD system, the system will need to be tested. Heartbeat management should test the service to see whether it answers to all Heartbeat's requirements. Refinements to the system, based on management's comments, should be made after this testing phase.
2. After the interface between the server and the Heartbeat database is created, it needs to be tested to ensure that data can be transferred to the Heartbeat database without any problems. If problems are detected during this testing phase, adjustments need to be made to solve the problems.
3. After report designs are created, training material is developed and both the previous testing phases are successfully completed, a pilot test of the system as a whole should be conducted. This should be done by selecting 5 CCWs to be trained on using the system. After their training, these 5 CCWs will be asked to each submit 10 surveys via their cell phones. This will result in 50 completed surveys. The data from these surveys will be used to create sample reports. These sample reports will give management a clearer understanding of the capabilities and usefulness of the system. After this trail run refinements can be made. Interviewing the CCWs that used the system will give an indication of how the system/survey can be made more user-friendly. Management will also be able to give more specific instructions with regards to report design.

5.4.3) Training program for users

In order for the new implemented USSD system to operate as planned, it is necessary for the users (CCWs) to understand exactly how this new system will work. Following the principles of the Behavioural Modelling Training Method, an action plan, with regards to the training of users, is assembled:

Task (what?)	Person Responsible (who?)	When?
The skills required to use the system are defined	Trainer	22-26 November
A brief overview is given of how to use the system	Trainer	22-26 November
An expert will model the use of the system by using the correct behavior	Trainer	22-26 November
CCW will try to use the system and the correct behavior by means of role-play	CCW	22-26 November

Table 11: Training plan

The Behavioural Modelling Training Method makes use of humans' inherent instinct to observe others in order to learn a new skill. By observing a trainer use the proposed USSD system, CCWs can learn how to use the system themselves.

5.4.4) Training material

In order to train users on how to use the system, training material need to be created. This material should be written and presented in such a manner that CCW will easily understand it. CCWs have different educational backgrounds and although all CCWs are required to be able to read, this training material should be suited for persons with very low literacy levels.

An example of a training sheet that explains how to use the proposed USSD system in a step by step manner is displayed in Figure 26. More training material will need to be created after the final USSD system is developed.

A five step training sheet for the new USSD system

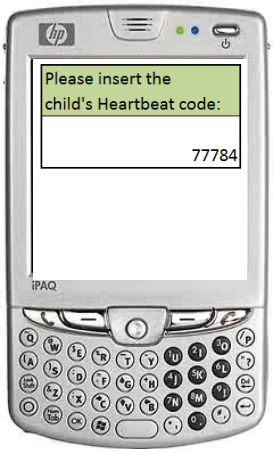
Step 1:

Dial the number 086281919# from your cell phone

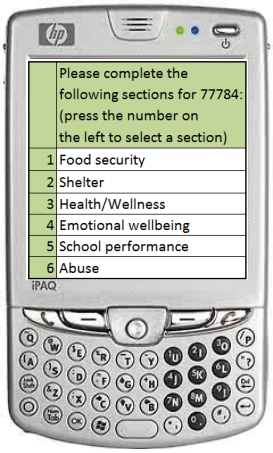
Step 2:

The following images will appear on your screen. Complete the survey as directed.

Screen 1



Screen 2



Screen 3

When you pick one of the numbers on screen 3, one of the following sections will appear.

1	Food security:
1	Child gets food 3 times a day
2	Child is fed regularly but less than 3 times a day
3	Child gets food at ASC and sometimes at home
4	Child only gets fed at ASC

2	Shelter:
1	Very good shelter/housing conditions
2	Good/Appropriate shelter
3	Bad shelter
4	Very poor shelter/housing conditions

3	Health/Wellness:
1	The child is very healthy, almost never gets sick
2	The child is healthy, but gets sick sometimes
3	The child gets sick regularly
4	The child is sick most of the time

4	Emotional wellbeing
1	The child is always happy, in a good mood

2	The child is happy most of the time
3	The child is sad a lot
4	The child is always depressed or in a bad mood

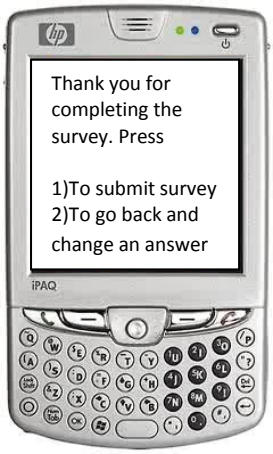
5	School Performance
1	The child performs very well at school
2	The child is happy at school, does his/her homework
3	The child doesn't like school or homework
4	The child doesn't attend school or do homework

6	Abuse
1	The child always feel safe
2	The child feels safe most of the time
3	The child feels threatened
4	The child is being hurt/abused by someone

After you completed a section by selecting a number 1, 2, 3 or 4, screen 3 will appear again. Complete all of the sections in this manner.

Step 3:

After completing each of the six sections above the following screen will appear. Press 1 if you are finished or press 2 if you want to go back to change one of your answers.



Step 4:

Take a photo of the child's bar-code with the camera on your cell phone.

Step 5:

Send the picture of the bar-code to the number 086281919

Figure 26: An example of possible training material

5.5) Improve Process continuously / Monitor business process

In order to monitor the success of the newly implemented business process a performance assessment of the outcomes of the new system will need to be done.

The outcome of this system (refer to the IDEF0 model in Figure 18) is an updated database. However the fruit that Heartbeat will reap from this updated database will be the true outcomes of this project. It is these outcomes that need to be defined and needs to be monitored to measure the success of the new system and keep improving it continuously.

The continuous updated state of the Heartbeat data base will enable:

- Better service delivery: Because children's needs would be more closely monitored. This would certainly be the most valuable benefit of the new system.
- More effective reporting to external stakeholders such as government: The database will be able to indicate very accurately how many children were visited.
- More effective reporting to donors from the SACIN program: The database will be able to generate a report that will give a donor much wanted information on the wellbeing of the child he/she is supporting.
- More effective reporting to management: The database will be able to indicate how many children were visited by whom, at what time.
- A performance assessment tool: The performance of CCWs can be compared to that of other CCWs as well as to his/her own performance of the past.

By monitoring the effectiveness of these outcomes, the process can be improved.

Conclusion

The project explored the feasibility of addressing Heartbeat's CCW home visit reporting challenges, specifically pertaining to service verification, data collection, reporting and other monitoring and evaluation tasks by replacing the current paper based reporting system with a more efficient mobile technology enabled system. Several contending mobile technologies were examined. Unstructured Supplementary Service Data (USSD) and Interactive Voice Response (IVR) technologies were identified as possible tools allowing Heartbeat's CCWs to report back on home visits made to the children more efficiently and reliably. The proposed USSD system proved to be the most feasible. The BPR process followed in Chapter 5 addressed all of the objectives that was specified in Chapter 1, namely to optimise home visits, to select a verification technology, to select a technology that can be used to report on home visits , to train users to use the new system and to do effective reporting. If the proposed USSD system is implemented it will optimize the home visit procedure, and facilitate an up to date database, which in turn will enable more effective reporting to both external and internal stakeholders and better informed decision making.

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