

Implementation of ICTs in Health and Management Information System for Zanzibar

Juma LUNGO¹, Yahya SHEIKH³, Faraja IGIRA², Ola TITLESTAD², Masoud MAHUNDI¹, Omar SULEIMAN⁴, Abubakar BAKAR³, Hashim TWAAKYONDO¹ & Jørn BRAA²

¹University of Dar es Salaam, P. O. Box 35062, Dar es Salaam, Tanzania
Tel: +255 222 410657, Fax: +255 222 410514, Email: jlungo@udsm.ac.tz

²University of Oslo, P. B. Box 1080 Blindern, Oslo, 0316, Norway
Tel: + 47 22 85 24 10, Fax: +47 22 85 24 01, Email: farajam@ifi.uio.no

³The State University of Zanzibar

⁴Ministry of Health and Welfare, Zanzibar, Tanzania

Abstract: In November 2004, the Ministry of Health in Zanzibar and its stakeholders conducted a HMIS review. The results revealed that the HMIS is fragmented and does not support data driven decision-making. To address these shortcomings, a roadmap towards development of HMIS was agreed as follows: (1) development of essential datasets, (2) developing and implementing a computer database. The decision was to take the District Health Information Software (DHIS) developed by the Health Information System Programme (HISP) and customise it to fit the context in Zanzibar. HISP is a global project using Action research and Participatory design approaches to empower the emerging local health management structures and health workers through improved and locally based information systems in a number of developing countries. At the time of writing this paper there is essential datasets and an implemented computer database used for data storage, analysis and reporting.

Keywords: Open Source, DHIS, Information Systems, HISP, Action research.

1. Introduction

According to the national census of 2002, Zanzibar has 981,754 population with 500,908 female and 480,846 males [1]. Administratively, the country consists of two highlands-Unguja and Pemba. The Zanzibar Health Sector has a number of sub-systems for collecting and reporting data, some of them are health facility based and others are programme based such as for the Expanded Programme on Immunization (EPI), Schistosomiasis/Helmenthesis Control Programme, Nutrition Unit, Reproductive and Child Health (RCH), TB and Leprosy, Zanzibar AIDS Control Programme (ZACP) and Malaria Control Programmes. All these vertical programmes have introduced their own specific forms for data collection. As a result the Primary Health care Units and hospitals in Zanzibar have demonstrated the availability of different forms (from handwritten pages to printed forms), for data collection and reporting. In other countries similar problems of un-standardized health information systems (HIS) were studied and actions were taken as presented in [2, 3].

At the end of 2004, a HMIS review revealed that the Health Management Information Systems (HMIS) in Zanzibar is fragmented and does not support data driven decision-

making. Specifically, there were excessive amounts of data being collected, which have no link to indicators, and there was overlapping and inconsistent of data reporting. To address these shortcomings a review team recommended the need for developing standardised data collection forms, define reporting procedures and computerising data silos and analysis mechanisms. A roadmap was developed which define the main objectives as terms of references for any one who would be assigned to address those shortcomings.

2. Objectives

A roadmap towards development of HMIS was agreed as follows:

1. Developing essential indicator and data sets and streamline the data collection tools accordingly to addressing the data and information needs.
2. Developing and implementing a computer database to assist the process of storage and analysis of health data.

The focus of this paper is to describe the HMIS development and implementation process in Zanzibar during the period of January 2006 till December 2006. Specifically, we address the opportunities and challenges encountered during the implementation of ICTs as well as the outcome of the process in terms of the system developed within the HMIS in Zanzibar.

3. Methodology

This study falls under “Action Research Paradigm”. Action research has been typified as a way to build theory, knowledge, and practical action by engagement with the world in the context of practice itself (see, e.g.[4-7]). Dick, explains an action research as a research approach, which has the dual aims of action and research [8].

- action to bring about change in some community or organization or program;
- research to increase understanding on the part of the researcher or the client, or both.

In line with Checkland’s arguments, on the one hand the project aimed at bringing changes in the client systems. Standardizing the collation, storage, retrieval and analysis of health data was the focus. On the other hand the research component is of particular importance since researchers bring in theories and knowledge that complement the process of taking practical actions [6].

Action research aims at contributing to both the practical concerns of people in an immediate problematic situation and to the goals of social science through joint collaboration within a mutually acceptable ethical framework. The practical domains addressed here is the HMIS of Zanzibar. The ideal domain of action research is revealed in three distinct characteristics of the approach [9, p. 136]:

- the researcher is actively involved, with expected benefits for both researcher and the research client.
- the knowledge obtained could be immediately applied and
- the research is a cyclical process linking theory and practice.

Inline with this action research practices, the authors played two main roles: first, some were among the software programmers and others coordinated the analysis, design and implementation activities of the projects as team leaders from time to time.

The five phases of action research approach were adopted in the project as it is argued that the most prevalent description of action research is detailing a five phases, cyclical process. This is described as an ‘ideal’ exemplar of the original formulation of action research in [9]. The ideal approach first requires the establishment of a ‘client-system infrastructure’ or research environment. Then, five identifiable phases are iterative: (1) diagnosis, (2) action planning, (3) action taking, (4) evaluating, and (5) specifying learning. The key assumptions of action research are that “social settings cannot be reduced for

studying and that action brings understanding” [10]. A detailed account of the way the research was conducted follows in the description of the research components.

4. Developments

In order to implement the review recommendations, the Ministry of Health and Social Welfare Zanzibar (MOHSW) created a HMIS taskforce to foresee and implement the HMIS. The Health Information System Programme (HISP) was contracted as a technical implementation team to work together with the taskforce and other stakeholders. The strategy of outsourcing external force towards implementing the HMIS was recommended as argued in [11].

HISP is a large and global project using Action research and Participatory design approaches to empower the new and emerging local health management structures and health workers through improved and locally based information systems in a number of developing countries. HISP is mainly coordinated by the University of Oslo, Norway in collaboration with local authorities such as local Universities and Ministries of Health in each country where HISP has a network. In our case, we had HISP Zanzibar as a branch of HISP network. HISP Zanzibar, the taskforce and the development and implementation process were funded by DANIDA to accomplish the assigned task.

While the taskforce was a team of health officers working under the MOHSW, HISP Zanzibar is a team of hired software developers, masters and PhD students registered at the University of Oslo. The HISP team was organized in such a way that, a memorandum of understanding was signed between the University of Dar es Salaam and University of Oslo to cooperate in research and development and training activities. The University of Dar es Salaam then assumed responsibility for all people working in the HISP Zanzibar. That is to say the developers had contracts signed at the Computer Science Department of the University of Dar es Salaam.

4.1 Development of Essential Indicator and Datasets

When the task started in January 2005, HISP Zanzibar and the Taskforce started by preliminarily reviewing current health data collection tools. They listed all health data elements and indicators. This enabled them to map between the indicators and health data elements. When we started, *we had a rule that, if a data element is not used to derive any indicator, it should be considered for being dropped.* This approach enabled us to drop as many data elements as possible.

Then we started to build the ‘data dictionary’. Basically what we did is to ensure that for each health data element; there is one and only one definition. The idea was that all health workers must have a single point of reference in interpreting health data elements. Again this enabled us to delete some data elements that we considered as duplicates for they carried different names but the same meaning.

The other activity that followed was to re-design the data collection forms. This required developing new data collection forms and testing them. The focus here was that the forms must be simple to complete. For example, we focused on a single A4 page as compared to the old long forms. After designing the forms, we took them back to the field and tested them. We gave the forms to health workers and ask them to fill real health data. The forms were prototyped in four out of ten districts, two districts in each of the Islands: Unguja and Pemba. The main purpose of prototyping was to test the applicability of the new tools in terms of coverage and user friendliness. Comments from the pilot districts were collected.

In March 2005, a workshop representing all district medical officers and vertical health programmes was conducted to confirm new essential datasets (a minimum list of health

data elements). Later in December 2005 a bigger meeting led by HISP consultants was conducted following one week of fieldwork in order to:

- define the essential indicator set basically based on Millenium Development Goals (MDGs) and Zanzibar Poverty Reduction Plan (ZPRP); and
- revise the data collection tools based on the defined indicators and the collected comments from the pilot districts.

The meeting cleared the way for rolling up the newly designed data collection forms to be used in all health facilities in January 2006.

Since this countrywide implementation, a number of training and user support have been provided to health workers at different health care levels particularly in the health facilities.

Recently, several interventions to strengthen the HMIS activities have been carried on including the revision of data collection tools and indicators, following one year of use and the preparation of the HMIS guideline – a policy document that offers full authority and directives to the HMIS from all its stakeholders.

4.2 Computerization of HMIS

During the meeting of November 2004, the District Health Information Software (DHIS) was chosen as a framework for developing a working software for the HMIS in Zanzibar. DHIS was originally developed by the HISP project in South Africa. The DHIS is free and open source software. As HISP work has been rolled out in different countries working as a network, knowledgebase for developing the DHIS is sought around the HISP networks and experts are moving from one country to another for the purpose of sharing experiences.

Immediately after acquiring the project of computerising the HMIS in Zanzibar, the HISP coordinator signed a contract with DANIDA and started to build a development team in Zanzibar. A local team of programmers was hired to customize the DHIS as outlined earlier. As a network, the HISP Zanzibar has invited HISP members from India, Norway and South Africa to provide technical support and know how to the local team.

The DHIS has several functionalities such as maximum and minimum ranges, validation rules, data definitions, indicators, report generator, a number of modules ranging from Primary Health Care (PHC) to hospital and Tuberculosis (TB), organizational unit infrastructure, and annual surveys. DHIS was designed to capture health data at different levels of the HMIS: district level, regional level and at the national level. DHIS is distributed with its source code; it is distributed for free in a website and in CDs. In this project, the main activities were to setup the DHIS database and customizing DHIS data entry forms as well as formulating various reports to be used in the Zanzibar HMIS.

The link between the DHIS developers in South Africa and the customization team in Zanzibar is maintained primarily through a mailing list. The DHIS bug track website are sometimes used to find solutions for similar cases. To connect the Zanzibar team to the DHIS community, bugs are communicated through emails, SMS, and instant messages but in most of the time bugs are reported through private email addresses of the DHIS experts in South Africa.

During the initial implementation of the DHIS in all the districts, no single computer was connected to the Internet a situation that forced the DHIS to make its way to the districts on CDs and flash disks. Also the health workers from the districts had to report through flash disks. It was by coincidence that during this project, another major project for networking all districts in Zanzibar was taking place. As a result all computers in the districts have access to the Internet. At the time of writing most districts have Internet connection and now they send their reports to the Ministry of Health through emails. This also improved the communication between the HISP team and users of the DHIS and speeded up DHIS users' learning curve.

5. The Research Components

The Action Research phases were followed cyclically during the execution of the projects. Analysis of the action research phases is now presented:

Diagnosing: Diagnosing phase corresponds to the identification of the primary problems that are the underlying causes of the organization's desire for change. According to [9], diagnosing involves self-interpretation of the complex organizational problem to develop certain theoretical assumptions about the nature of the organization and its problem domain. We solved the problem of health data collection, storage, compilation and analysis by introducing proper data collection tools and implementing a computer database. Due to the nature of the client systems infrastructure, it was observed that open source solutions can enable wide sharing of development process and sharing tools and experiences on similar application domains and reduce the cost of implementation.

Action Planning: After the diagnosing phase, researchers and practitioners then collaborate in the next activity, action planning. The discovery of the planned actions is guided by the theoretical framework, which indicates both some desired future state for the organization, and the changes that would achieve such a state. The plan establishes the target for change and the approach to change. In the case of the HMIS, an existing health data analysis tool known as District Health Information Software (DHIS) was acquired as an open source framework for fulfilling the HMIS requirements. It was further planned to engage programmers who actually executed and are still executing the project.

Action Taking: This phase implements the planned action. The researchers and practitioners collaborate in the active intervention into the client organization, causing certain changes to be made. In the HMIS case, the DHIS framework was obtained from a website free of charge. The database currently customized whereby health data elements were introduced, and the user-interface (forms and reports) were customized to suit the Zanzibar HMIS.

Evaluating: After the actions are completed, collaborating researchers and practitioners evaluate the outcomes. Evaluation includes determining whether the theorized effects of the action were realized, and whether the effects relieved the problem. Through meetings and discussions the overall HMIS implementation was evaluated leading to revision of the indicator set to cater for the uncovered areas of the HMIS or those areas which were under implemented. The team also have been upgrading to higher releases of the DHIS software. These new releases are the results of the comments given from various HISP nodes including Zanzibar.

Specifying Learning: According to [10], knowledge gained in the action research (whether the action was successful or unsuccessful) can be directed to three audiences First, restructuring of organizational norms to reflect the new knowledge gained by the organization during the research. Second, where the change was unsuccessful, the additional knowledge may provide foundations for diagnosing in preparation for further action research interventions. Finally, the success or failure of the theoretical framework provides important knowledge to the scientific community for dealing with future research settings [9]. The project has to a large extent achieved its goals and thus is successful actions. More stakeholders have seen the impact and are collaborating in the implementation process.

6. Opportunities and Challenges

In this project we had opportunities that it was a timely issue where there was a need for a functional HMIS system. This acted as a natural force to enhance maximum cooperation between technical team and political leaders. In fact the quest for implementing HMIS in

Zanzibar made us to win the political factor mentioned several times as one of the bottlenecks for implementing HMIS.

The implementation of the HISP project was done in parallel with involving eleven key health workers from the HMIS unit, zones and districts in an extended course in HMIS at the University Of Dar es Salaam, Tanzania. This course had been instrumental in creating a shared understanding and general knowledge about key principles related to HMIS.

During the design and implementation process, there were three main challenges:

- (1) Developing effective, need based and indicator driven datasets: this challenge reflects the conflict between stakeholders (mainly various health care programmes) of the HMIS. Specifically, aligning the interests of various stakeholders to agree that a particular data element should be dropped and so to adopt new forms was a big challenge. In fact we noticed that, it is easy for stakeholders to add more health data elements than dropping one.
- (2) Training of district officers in managing computer database in the context of poor computer literacy: ‘computers are strange talking machines which scares illiterate computer users’, a health officer told us. Most of the health workers are not conversant with computers. As we computerise the HMIS, we enforce changes to their working practices that in any means they have to interact with computers. The challenge was to train health workers to operate computers and then to update, query and manage large database of health data. The HMIS course at the University of Dar es Salaam helped us at large. We sent health officers to the course, where they had intensive crash program for using computers and analysing health data using computers.
- (3) Gradually improve the quality of data and use of information for management. The challenge here is to change the attitude of senior health officers to rely on health data to make sensible decisions. To overcome this challenge we invited professionals in health systems from various countries to stress the importance of data driven decision-making. We emphasize on feedback mechanism to inform the health workers at the health facilities that somebody up there is looking and appreciating their work of collecting health data. This is a motivation mechanism to improve the quality of data.

7. Project Outcomes and Business Benefits

Despite the challenges encountered during the development and implementation process. To date there are practical outcomes and business benefits achieved.

Essential datasets and indicators have been developed and health workers are collecting and reporting data basing on the developed datasets and indicators. Furthermore, reporting routines form one level to another has been established.

At the time of writing the DHIS in Zanzibar is customized to the extent that Zanzibar health data collection forms are successfully electronically mimicked in the DHIS and that the DHIS is installed and being used in all districts, the zonal offices, HMIS unit (national office) and to most programme offices (the vertical programmes whose earlier forms are integrated in the DHIS). DHIS users training workshops have taken place and the HISP team continues to provide in-service and onsite training to more staff and provides user support in all the levels as a way of establishing the system’s sustainability as recommended in [12].

All districts officers are now capable of doing basic and more advanced analysis of data using the DHIS. While reporting their third quarter of this year (2006), all the districts used DHIS to prepare their third quarter reports and we expect that they will continue to use the DHIS for the fourth quarter and subsequently the annual report for the year 2006. The HMIS Unit in collaboration with HISP Zanzibar team plan to use DHIS to produce the 2006 country health bulletin. In all the reports raw data together with the indicators are presented in both tabular and pictorial forms such as bar charts, line charts and histogram.