UNIVERSITY OF OSLO
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Improving routine health information management at health districts in Zanzibar

An action research study

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To my mom

Abstract

This research falls under the domain of information systems development in developing countries. The context of the research is Zanzibar, Tanzania. The main objective of this research was to study the existing HIS, identify problems related to it and propose and implement solutions for the purpose of improving it. The research focused on the study of the HIS at the local levels aiming at exploring the procedures, tools and problems related to routine data collection, storage, analysis and information uses; and to inform 'prototyping' of DHIS software for its adaptation to Zanzibar's healthcare system and context, as an alternative solution to the existing paper-based system.

A longitudinal case study approach was used where two cases from two different districts were studied and compared. The two districts are North 'A' in Unguja Island and Micheweni in Pemba Island. Qualitative research methods were used including ethnographic interviews, observations and document analysis. Empirical data were analysed following the principles of grounded theory. A participatory action research approach was employed regarding the process of introducing changes.

The research revealed some efforts in the process of data collection, analysis and information use at the local levels of the healthcare sector in Zanzibar. However, these efforts are constrained due to the problems that exist in the existing HIS. The problems are grouped into three main areas: (1) lack of a clear information strategy within the Ministry of Health resulting in fragmentation of the HIS, especially at the higher levels and the absence of clear guidelines; (2) scarcity in human and non-human resources; and (3) the problem of information system design that caters only for the needs of the top levels of the national healthcare system without addressing local levels needs. The problems are interrelated and are associated with the socio-cultural, economic, political and organizational structures that shape the healthcare sector.

Acknowledging the social interlinking of the HIS and the work environment, I conceptualize HIS as socio-technical systems. The HIS development process is viewed from the information infrastructure perspective. The process involves changing from the old existing HIS to the new integrated HMIS and the process of computerising the new HMIS. The process acknowledges the importance of the *installed base* where the development of the infrastructure is highly influenced by the existing systems, work process, users and organization procedures that govern the overall processes. Actor-network theory has been used to unpack the socio-technical complexity related the development process. The development process calls for the need of flexibility of the infrastructure in order to prevent possible lock-in effects when the infrastructure gains momentum towards inertia. For that purpose, a *cultivation* approach was used.

The research advocates for the importance of garnering political support for the process of introducing new technologies into the healthcare organizations in developing countries. Viewing the process from a socio-technical perspective helped to identify important aspects to be considered by the organization in order to align with the introduced change. This helped to identify issues in advance that may facilitate or inhibit changes in order to plan how to reduce the gap between the technology requirements and the real situation within the organization. The issues identified include identifying the existing staff capabilities in terms of quantity and quality in relation to the requirements of the new technology, identifying and securing financial support, identifying areas and structures of the organization that are going to be affected, and suggesting possible solutions in order to align the organization in the right direction to respond to the introduced new technology.

Keywords: **Health information systems, public health, developing countries, information infrastructures, actor-network theory, socio-technical systems, participatory action research.**

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List of acronyms used

AIDS – Acquired Immune Deficiency Syndrome
ANC – Antenatal Care
ARI – Acute Respiratory Infections
DANIDA – Danish International Development Agency
DHIS – District Health Information Software
DHMT – District Health Management Team
DMO – District Medical Officer
EPI – Extended Programme for Immunization
GIS – Geographic Information System
HCF – Healthcare Facility
HIS – Health Information System
HISP – Health Information System Project
HIV – Human Immune Deficiency Virus
HMIS – Health Management Information System
IMR – Infant Mortality Rate
MCH – Maternal and Child Health
MMR – Maternal Mortality Rate
NORAD – Norwegian Agency for Development cooperation
OPD – Outpatient Department
PHC – Primary Health Care
PHCC – Primary Healthcare Centre
PHCU – Primary Healthcare Unit
TB – Tuberculosis
TBA – Traditional Birth Attendant
UNFPA – United Nations Population Fund
WHO – World Health Organization
ZHMT – Zonal Health Management Team
ZMO – Zonal Medical Officer

1
Introduction

1.1 Background

The health status of any society or country is an important indicator of human development. In developing countries most people rely on public healthcare services, therefore the condition of public healthcare largely determines this human development indicator. Yet public healthcare in most developing countries is in a state of shortage of resources in both material and personnel. This largely limits their capacity to improve the health status of the related society. A crucial task is to manage the provision of proper healthcare services to the related society based on the use of available resources while seeking more. To support this management, there is a need to develop a proper Health Information System (HIS), which will be a supporting tool for decision-making. This is the main theme of this thesis.

Figure 1.1: Health information system as a prerequisite to healthcare provision.

A baby just born at Kivunge Cottage Hospital. The healthy future of the baby relies on a proper healthcare system, which in turn relies on a proper HIS. (Photographer: Author, August 16, 2004)

Long queue of patients/clients at Mahonda PHCU. Can managers and other decision-makers improve the situation without a proper HIS? (Photographer: Author, November 30, 2004)

Health information systems are required to generate appropriate information, which will be used by health planners and decision-makers to properly manage healthcare at all levels. The use of proper HIS can therefore improve the healthcare management, and in turn will improve healthcare services delivery. An ideal structure of the HIS should permit generation of the necessary information for decision-making at each level of the healthcare system, from the local level all the way up to the national level.

Wilson *et al.* (2001a) define a Health Information System (HIS) as "a set of tools and procedures that a health program uses to collect, process, transmit, and use data for

monitoring, evaluation and control" (Wilson *et al.* 2001a:82). HIS is a functional part within the framework of a comprehensive healthcare system aimed at supporting the healthcare system, in order to improve the health of individuals and the population. Therefore, HIS is a *Management Information System* within the healthcare system. Heeks (1998) defines a Management Information System as:

> An Information System that provides reports, which assist the managerial monitoring and control of organizational functions, resources or other responsibilities.
>
> (Heeks 1998:2)

Within the structure of any HIS there are two kinds of data collection procedures: routine data collection and non-routine (periodic). Routine health information can be defined as "information that is derived at regular intervals of a year or less through mechanisms designed to meet predictable information needs" (RHINO 2001:11). These include health services statistics for routine service reporting and special program reporting such as malaria, TB, and HIV/AIDS; administrative data; epidemiological and surveillance data; data on community-based health actions; and vital events data for births, deaths and migrations. The domain of this thesis is the routine health information system development at the local levels of healthcare system in development countries.

1.2 The research problem

The main problem addressed in this research is that of enabling changes, that is, transforming the existing health information system into a tool to support decision-making. The study focused on the routine services reporting at the local level of the health sector, that is, the health districts and healthcare facilities. The rationale behind this focus is that the routine data are the basic data for patients and clients' management decisions. Also, the problems of inefficient and chaotic data collection and use of information in health facilities and the district levels typically apply to the routine services reporting component of the health information system (Sauerborn and Lippeveld 2000).

The context of the research is Zanzibar Tanzania, a developing country within Sub Saharan Africa. The research focused on the study of the health information system at the local levels, aiming at exploring the procedures and tools used to collect and store routine data, identifying problems related to the current information system and to inform 'prototyping' a software system, District Health Information Software (DHIS), for its adaptation to Zanzibar's healthcare system and context, as an alternative solution to the paper-based system. The research is part of the ongoing research and software development project, the Health Information System Project (HISP), which is currently underway in several countries including Tanzania mainland. The research formed the basis to extend HISP-Tanzania to Zanzibar.

This research aimed at making a qualitative study of the problems related to the HIS in developing countries using a case study from Zanzibar Tanzania. The research also analyzes the issues related to software solutions to improve the HIS based on the

use of DHIS software, an open sources software originally developed in South Africa and later used in several other developing countries. Findings and recommendations of this study are meant to be useful in assisting policy makers and health planners in Zanzibar and other developing countries as well as information systems designers, developers and researchers.

1.3 Research questions

The problems addressed in this research are expressed in the following questions:

1. How can management and use of information be improved at local levels of the health information system?
2. To what extent may the use of the software system, District Health Information Software (DHIS), improve efficiency and effectiveness in the processes of data analysis, that is, providing means for analysing data and producing higher quality information in more cost-effective ways?
3. How can knowledge obtained from organizational change experience in Zanzibar be used when introducing IT solutions to public health organizations in other developing countries contexts?

To be able to answer those questions, the research aimed to:

1. Assess the routine services reporting at the local level of the health information system in Zanzibar in order to realize the problems related to it and suggest any possible solutions to improve it.

   To achieve this aim, the research had the following specific objectives:
   - To identify tools used to collect and store routine data.
   - To identify methods used for data processing and analysis.
   - To identify, which information is used at local level? Who uses the information? And how is the information used?
   - To identify problems associated with the existing information system, and identify possible solutions to overcome the problems.

2. To 'prototype' DHIS software for its adaptation in the Zanzibar healthcare system and context, as a tool for analysing routine data at the health district level as well as a reporting tool for the zone and national health levels, and as an alternative to the paper-based system in order to improve efficiency and effectiveness of the information system.

3. To learn about challenges and opportunities encountered in implementing the DHIS software at health district level in Zanzibar.

   To achieve these I specifically aimed at:
   - Software installation and configuration.

- Populating the database with health data and demonstrating it to the users at the district offices, zonal offices and at the Ministry of Health headquarters.
- To adapt the software by creating customized reports according to the local needs.

However, when I entered the field site and realised the situation, I aimed to acquire political garnering for the process rather than going directly to the software implementation activities.

1.4 Research settings and methods

In this research, a longitudinal case study approach was used where two cases from two different districts were studied and compared. The two districts are North 'A' in Unguja Island and Micheweni in Pemba Island. Qualitative research methods were used for data collection and analysis. The methods for data collection included ethnographic interviews, observations and document analysis. A participatory action research approach was employed regarding the introduction of DHIS software.

1.5 Research domain and motivations

Many developing countries are engaged in decentralization including attempts to strengthen health management at local level, enabling data processing and use of information in local decision-making. Some countries reported include Chad (Lippeveld *et al.* 1992), Tanzania, (Rubona 2001), Mozambique (Mwaluko *et al.* 1996) and Pakistan (Mujahid 2002), concentrating on routine health information systems. However the situation in most developing countries, including some of the above mentioned, is still not satisfactory. The information systems are typically fragmented into several vertical programmes and only serve the needs of the administration, not enabling local use of information. The information system management is often heavily centralized and having poor infrastructure with inadequate technical and financial support. Data on individual healthcare activities are irrelevant and of poor quality with the information produced not linking to a reference population (Lippeveld 2001). Moreover, the information is rarely used for evidence-based decision-making. "[Most data] remains unprocessed, or, if processed, unanalyzed, or, if analyzed, not read, or, if read, not used or acted upon" (Chambers 1994 cited in Lippeveld 2001:18). This situation therefore calls for more research to be done within the domain, and so I was motivated.

Personally I was also motivated towards the practical contribution on the development of the health information system for Zanzibar's healthcare system, which is in a state of decline due to shortage of resources. The results of this research will therefore be very useful input to the improvement of the health management system, which is very important in management of the scarce available resources, so as to accomplish the Ministry's goal to provide sustainable and equitable high quality healthcare services to all Zanzibaris. More generally, I am interested in improving the social welfare of my own people including myself. The courses that I

have taken in information systems development, which focused on social perspectives of information systems development, helped me greatly in formulating more realistic strategies for this research in addition to my informatics background.

1.6 Conceptual framework and theoretical perspective

Theories and concepts used to analyze the problem stated in this thesis are organized into three main groups:

1. HIS as socio-technical systems
2. Information infrastructure
3. Systems development: cultivation and participatory approach

1.6.1 HIS as a socio-technical system

An HIS is made up of a number of elements: the artefacts with which data are being collected, stored, processed and transmitted; the people who perform those operations and the organization procedures governing the HIS operations and the working staff. Furthermore, they are influenced by the political, economical and socio-cultural factors around the organizations where they are installed. Hence, success or failure of HIS development and implementation is highly affected by all these factors. I therefore adopt a socio-technical concept of HIS. The concept is drawn from the concept of Walsham *et al*. (1988) of a social perspective of information system. In this concept, it is argued that information systems should not be regarded as technical systems with behavioral implications but are better conceptualized as social systems in which technology is only one of the elements

1.6.2 Information Infrastructures

Healthcare organizations are complex with different stakeholders having varying needs. An ideal information system to support any healthcare organization is in no doubt a shared resource that is likely to evolve over time, and therefore the need for its flexibility is very important for that evolution. Systems of this nature are more likely to be described as infrastructures rather than being described according to a normal traditional system concept. I therefore can argue that the best way to describe and develop the HIS for the present and the future is by using information infrastructure theory.

According to Hanseth and Monteiro (1998), “infrastructures are considered as always already existing; they are never developed from scratch. When designing a new infrastructure it will always be integrated into and thereby extending others or it will replace one part of another infrastructure” (Hanseth and Monteiro, 1998:13). Infrastructures are usually developed through extensions and improvements of the existing systems, called the installed base. This may include the existing reporting procedures, work processes and rules, the available computers even if there is no computerization, and users and other stakeholders who have direct or indirect influence to the existing HIS. The installed base is difficult to change and impossible to control due to its complexity and interconnectivity. This thesis acknowledges the

importance of the installed base and describes the complexity in the process of aligning the new system to the existing installed base. Actor Network Theory (ANT) is used to unpack the socio-technical complexity imposed on the information infrastructure development.

1.6.3 Systems development process

The fact that information infrastructures are established through complex and vast processes, implies that the notion of "designing" them needs to be critically reassessed. The assumptions about design are too much biased towards being in control of the situation, while naturally the infrastructures cannot be controlled once set. Therefore, it is more reasonable to think of design in terms of *cultivation* (Hanseth and Monteiro 1998:9). The concept of cultivation turns our focus on the limits of rational human control. The concept considers technological systems as organisms with a life of their own implying that we focus on the role of existing technology itself, i.e. the installed base, as an actor in the development process (Hanseth 2002).

The cultivation process also applies to the slow process of organizational change through negotiating and brokering between actors at multiple levels. The most important of these actors are the human actors influencing in one way or another the development and use of the infrastructure. This raises a need for involving the users in the development process. (Hanseth and Monteiro 1998) argue that when the developers are close to the users and consult with or involve them in the construction and trial stages, the network into which the intended user behaviour is inscribed will be stronger and accordingly harder for the users not to follow it. This may also lead to a more flexible use of the technology.

1.7 Expected contribution

This research aims to contribute knowledge to Masters students and researchers in health information systems and information systems in general in developing countries; information systems developers; and managers and staff at the Ministry of Health and Social Welfare, Zanzibar (MOHSW) as well as policy-makers and health planners in other developing countries.

In this research a qualitative study on how to improve the use and management of information at local levels of the health information system was conducted. An action research approach was used regarding the introduction of DHIS software. Analysis of these processes is addressed using theories and concepts from the domains of information infrastructure and social perspective of health information systems. Practically, the study contributed to the initiatives to introduce the use of DHIS software for data and information management, adapting it to Zanzibar's healthcare system and context. The expected theoretical contributions are within the domains of health information systems development in developing countries, and information infrastructures, especially in relation to the health sector.

1.8 Structure of the thesis

The thesis is organized as follows. Chapter 2 discusses the related literature and theoretical focus. Chapter 3 describes the settings of the research and chapter 4 explains the methods used. These chapters together with chapter 1 are aimed to provide a reader of this thesis with background knowledge sufficient for understanding the empirical findings, analysis of the empirical materials and discussion presented in later chapters. Chapter 5 and chapter 6 present the cases studied, where North 'A' District case study is presented in chapter 5 and chapter 6 presents Micheweni District case study. In each case the situation analysis of the HIS is explained following the presentation of the issues influencing the operation of the HIS. Chapter 7 presents an inter-case comparison, and a discussion on the process of introducing DHIS software in Zanzibar. Analysis of the empirical material is discussed in chapter 8. Analytical discussion and conclusions towards the problem area addressed are presented in chapter 9. Chapter 9 also presents the research contribution to knowledge, and possible further work based on the reflections on the findings presented. The appendices contain the ethical clearance and letters of permission, the interview guide used in the study, copies of reviewed documents and documents prepared and submitted to the Ministry of Health.

2

Literature review and theoretical framework

This thesis informs study and change, that is, by studying the existing HIS and then proposing and implementing appropriate solutions in order to improve it. In this chapter, I therefore build a theoretical and conceptual framework that will be used to discuss the current situation in different perspectives and also to unpack the complexity related to changes. The theoretical and conceptual framework is based on literature in the domain of HIS development and information infrastructure, and forms the basis of analysis and discussion of the study conducted. The chapter is organized into four major sections. Section 2.1 presents the existing situation of HIS in developing countries. The concept of socio-technical system of HIS used to describe the current reality of the HIS is presented in section 2.2. In section 2.3, I present a discussion on information infrastructure theory, and in section 2.4, I present the strategies for changing the information infrastructure. Section 2.5 presents the chapter summary.

2.1 Health Information Systems in developing countries

Many developing countries are engaged in decentralization including attempts to strengthen health management at local level, enabling data processing and use of information in local decision-making. Some countries reported include Chad (Lippeveld *et al.* 1992), Tanzania, (Rubona 2001), Mozambique (Mwaluko *et al.* 1996) and Pakistan (Mujahid 2002), concentrating on routine health information systems. However the situation in most developing countries including some of the above mentioned is still not satisfactory. The information systems are typically fragmented into several vertical programmes and only serve the needs of programme administration; they are not enabling local use of information. The information system management is often heavily centralized and having poor infrastructure with inadequate technical and financial support. Data on individual healthcare activities are irrelevant and of poor quality with the information produced not linking to a reference population (Lippeveld 2001). Moreover, the information is rarely used for evidence-based decision-making. “(Most data) remains unprocessed, or, if processed, unanalyzed, or, if analyzed, not read, or, if read, not used or acted upon” (Chambers 1994 cited in Lippeveld 2001:18).

2.1.1 The problem of data quality

Among the problems facing HIS in most developing countries are that of irrelevance and poor quality of data collected. See for example studies in Bhutan (Wilson *et al.* 2001b), Mozambique (Chilundo *et al.* 2004), Tanzania (Rubona 2001) and Pakistan

(Mursalin and Haque 2001). Data collected are most of the time incomplete, inaccurate and most of the times untimely reported. Several reasons have been given, for example, the lack of a consensus between producers and users of data at each level of the healthcare system regarding the information needed.

> Care providers receive little if any training in data collection methods, and they rarely are given standardized instructions on how to collect the data. They are poorly motivated to produce quality data, because most data collected are irrelevant to their own information needs. They rarely receive feedback on the data reported to higher levels, so they have little incentive to ensure quality of the collected data and comply with reporting requirements.
>
> (Lippeveld 2001:19)

In addition to this, those 'data people' at the central level may not use the data because of lack of trust to the data sent. The result of this is that, data collection staff tend to be less motivated and hence produce poorer quality data.

2.1.2 The problem of centralization and fragmentation

The above-mentioned problems may be caused by the centrally structured HIS commonly present in many developing countries. As Lippeveld (2001) argues:

> Routine health information systems in most countries are centrally planned and managed. Indicators, data collection instruments, and reporting forms usually have been designed by centrally located epidemiologists, statisticians, and administrators (called data people), with minimal involvement of lower-level line managers and providers of the health services (called action people).
>
> (Lippeveld 2001:19)

And also Mwaluko and Pazvakavambwa (1996):

> The decision on how much data is collected, processed, presented, by whom, to whom, when, etc. are dictated from the centre, and the grass-root level health worker therefore collects it because it is needed by those above. The data therefore tends to be too much as most of it is never used at the level collected nor for decision-making. Even if data is analyzed at central level, there is little scope to take timely and effective actions in response to problems identified with individual units because the person analyzing it is far from the place of action where the decision will be adequate. And anyway, there is no feedback of information generated from the data sent "up". In addition to this, the grass-root workers have no power to decide on the type and volume of data they will collect, and the data collected therefore tends not to be focused on priority issues of greatest concern to the district.
>
> (Mwaluko and Pazvakavambwa 1996:168)

This centralized information management results in a fragmentation of the HIS. National vertical programs in many countries have created separate 'program information systems' that tend to focus on one specific disease (e.g. malaria, TB), a specialized service (e.g., family planning information systems), or a management subsystem (e.g., drug management information system) instead of addressing management functions in a comprehensive way (Lippeveld 2001).

2.1.3 Poor infrastructure and inadequate resources

Any HIS requires proper infrastructure as well as human capacity and financial support in order to be successfully implemented and sustained. Yet most developing countries have an environment in which most essential resources are lacking. The health information systems operate in a state of inadequate human, physical, and financial resources (Lippeveld 2001). Health facilities are staffed by staff who are poorly trained in both medicine and statistics, have no water or electricity supply, lack the most essential HIS supplies such as printed forms or registers, and are located in geographically remote areas served with poor road infrastructure. The staff also are subject to high workloads. For example, a study in Mozambique by Mosse and Sahay (2003) shows that health personnel meet more than 100 patients a day leaving them without much time and energy to perform other administrative tasks relating to HIS (Mosse and Sahay 2003). All this affects the quality of data generated from the process of data collection through data transfer and its analysis.

Many countries have introduced computer equipment at the district level with attempts to strengthen HIS management, but have no qualified staff to maintain software and hardware (Lippeveld 2001), nor do they have enough capital to hire more staff. According to David (2000), the human capital costs of installing, training, operating and maintaining ICTs is estimated to be ten times that of the acquisition cost of the computer itself (David 2000 cited in Heeks and Kenny 2002). Basic supplies such as printer cartridges and paper are often out of stock. Often the most essential communication technology is lacking, such as a telephone line between the health unit and the district headquarters (Lippeveld 2001).

2.1.4 Information culture

To generate more relevant and more reliable information in itself is not sufficient. The information generated should be used for rational decision-making concerning a particular community. However, in most developing countries, neither healthcare providers nor managers effectively use the information they have. This problem can be related to information culture, where data are not valued with respect to its quality to support local action.

> Information culture relates to the policy and management environment and the incentives to use information for decision-making, as well as to the experience and attitudes of managers and planners with respect to the role of information in improving health system performance.
> (RHINO 2001:7)

Sapirie (2001) explains this problem exists even in those countries with successful stories of HIS implementation. In Zambia for example, the HIS pipeline was built and put into implementation nationwide since 1999 but the challenge remained of using the information generated, that is the interaction of the pipeline and the consumers (Simwanza and Church 2001). In Malawi, Chaulagai *et al.* (2001) state “the main problem in the current HIS is not a lack of information, but insufficient use of available information” (Chaulagai *et al.* 2001:117). In Cambodia, despite the functioning of HIS launched in 2001, there is lack of data culture and limited use of

information, especially at the provincial and district levels (Khemrary 2001). Other countries such as Tanzania (Rubona 2001) and Bhutan (Wilson *et al.* 2001b) also face the same problem as a part of the poor HIS. Therefore, there is a need to create an "information culture" geared towards the use of information for decision-making, by using a participatory and consensus-building process (Lippeveld 2001) with the involvement of care providers and managers at each level within the HIS.

2.1.5 IT in developing countries

"Information technology (IT) is computing and telecommunications technologies that provide automatic means of handling information. IT is therefore taken here to represent equipment: both the tangible hardware and the intangible software" (Heeks 1998:5). "Information technology can perform six types of operations: capturing, transmitting, storing, retrieving, manipulating, and displaying information" (Alter 1999:22). IT is therefore a supporting technology to improve the information process in any information system. Given its role in the current transformation of advanced economies, IT has the potential to affect health conditions in developing countries both directly and indirectly. IT can work directly by improving healthcare provision and disease prevention, in the sense that it can be used to improve HIS which in turn will help in improving service provision. IT can also work indirectly when used to improve the economic status of a country or a particular society.

However, the adoption of the technology is a challenge considering the context of the developing countries, and in the health sector in particular. Several issues impede changes including the existing poor infrastructure, lack of required skills among the health workers on the use of technology, the existing procedures of data collection, processing and reporting, and the information culture. Several studies identified these. In Mozambique, the study of the use and appropriation of IT with focus on the healthcare sector by Braa *et al.* (2001), revealed that computers and the internet are rapidly being spread to the provincial capitals and major districts, but the main problem identified is the lack of IT skills and education and poorly developed infrastructure including electricity (Braa *et al* 2001:1). In Tanzania, Splettstoesser and Kimaro (2000) report on the revoked import control order in 1993 that lifted the 1974 import ban of computers as a promising action for the technology advancement. In association to this, Lungo (2003) reported the distribution of computers by the Ministry of Health in July 2002 to all 117 districts in Tanzania (mainland) to facilitate health data processing efforts for the District Medical Officers (DMOs). However proper use of the technology is still a challenge (Lungo 2003).

IT adoption in developing countries involves not only the purchase and installation of the technology, but also a broad process of institutional capacity building. Lippeveld (2001) emphasizes that; "introducing computer technology is not necessarily the silver bullet that creates effectiveness and efficiency in health services. On the contrary, lack of appropriately trained staff and hardware and software problems sometimes result in the decay and obsolescence of expensive computer equipment, without any gains in decision-making" (Lippeveld 2001:24). This implies

that, in order to achieve positive results in the adoption and use of IT, the health sector has to invest in pre-service and in-service computer training for all health workers and the maintenance of both computer hardware and software.

2.1.6 Why do the HIS in developing countries fail?

As discussed earlier, HIS in most developing countries are under-performing. Attempts to develop new HIS in those countries have been made. However, past experience shows that the design of the new HIS resulted in failures and anticipated consequences if their technical aspects are emphasized and their social and organizational factors are overlooked (Anderson 1997 cited in Heeks 1999). To explain more about why this happens, and how the risks of failure may be reduced, Heeks (1999) describes the 'ITPOSMO' model of conception-reality gaps. In this model he argues that the greater the change gap between current realities and the design conceptions (i.e. requirements and assumptions) of a HIS, the greater the risk of failure.

Heeks (1999:1) identifies three typical large design-reality gaps affecting the HIS domain, which are associated with an increased risk of failure:

- ***Rationality-reality gaps***: that arise from the formal, rational way in which many HIS are conceived, which mismatches the behavioral realities of some healthcare organizations.
- ***Private-public sector gaps***: that arise from application in public sector contexts of HIS developed for the private sector.
- ***Country gaps***: that arise from application in one country of HCIS developed in a different country.

Of the three categories of gaps, rationality-reality and the country gaps are more important for the discussion in this thesis. These will be used to analyze how the rationality imposed on the development of the DHIS software can be aligned with the current situation in the healthcare organization in Zanzibar, and how software designed and developed in South Africa can be adapted to the context of Zanzibar.

The 'ITPOSMO' model of HIS conception-reality gaps, has seven dimensions that have to be examined when introducing a new HIS in order to minimize those gaps. The dimensions can also be used when assessing success of failure of a new HIS. The dimensions are:

- **I**nformation: Do the systems meet the real information needs of its users?
- **T**echnology: Does the system require large technology changes? Is the required hardware and supporting software easily available?
- **P**rocesses: Does the system support the processes the user wants to? Is it bringing about large changes in processes?
- **O**bjectives and values: Does the system support the objectives and values its user finds important?
- **S**taffing and skills: Does the system require a higher degree of skills than is available?

- **M**anagement and structures: Does the system bring about large management and structure changes?
- **O**ther resources: money and time. Does the organization have enough funds to support the new system?

The model acknowledges the need for the organizational consideration when adopting new HIS, particularly in the context of developing countries. The existing situation in most developing countries, especially in the public healthcare sector, favors a higher "reality-conception gap" when introducing new technology. Whatever simple the technology to be deployed is, the context most of the time requires more intensive training than it could be the case in developed nations. Also, in most cases there would be a need for investing in supporting hardware and software for the new technology. These issues, together with the existing organization settings and the economic and political situations, are most of the time inhibiting elements to the process of adopting new technologies. In addition, all these must be sustained for a period since the diffusion process is communicated through certain channels over time. Therefore, the change agent or person introducing the new technology in an organization should take into consideration the following aspects: the characteristics of the target organization, the characteristics of the technology or change itself, and the stages of adoption. Each of these should be analyzed and planned for, when introducing new technology in order for the changes to be successful.

2.2 HIS as a socio-technical system

An HIS comprises number of elements: the artefacts with which data are being collected, stored, processed and transmitted; the people who perform those operations; and the organization procedures governing the HIS operations and the people working. Furthermore, it is influenced by the political, economical and socio-cultural factors around the organizations where it is installed. Hence, success or failure of HIS development and implementation is highly affected by all these factors.

HIS is a supporting tool to the healthcare services provision. Without a healthcare system, there is no need for HIS. Therefore, HIS is a subsystem of a larger social system, established and running in a large social setting. Consider a medical practitioner at a healthcare facility collecting data routinely based on the services he/she provides as the patients/clients come to request the services. The services could only be provided if the government or other agency gives support. On the other side the tools used and the staff using the tools also affect the data collection process. The processes therefore seem to be complex with the starting and ending points far distant and unclear. Without considering this complexity, it could not be simply argued, for example, why the data collected are of poor quality?

Therefore, HIS cannot be understood independently of the people around it, their social relationships, their culture and the work practices that they are engaged in

within everyday life. The study of HIS involves the study of this complex interlinking between the different people, the technology and the material artifacts, the organizations and the organizational settings. It involves an intensive study of the work environment in order to deeply understand how people work and what kind of organizational practices they are engaged in. The same is the case for HIS development.

Walsham *et al.* (1988) conceptualize computer-based information systems as social systems in which technology is only one of the elements. Information systems are not technical systems which have behavioral and social consequences, but are social systems which rely to an increasing extent on information technology for their functions (Hirschheim 1985 cited in Walsham *et al.* 1988). More clearly, information systems are socio-technical systems as they involve both technological and social aspects. This turns our focus into conceptualizing IS development as a socio-technical process rather than a typical technological process.

This is in contrast to the traditional IS research where IS development is concerned with only the technical side in terms of hardware and software. But IS are much more than computers and telecommunications equipment, as they involve also people and their actions in the organizational settings in which they work (Heeks 1998). Bjørn-Andersen *et al.* (1990) argue that in the ongoing traditions among the IT and IS designers, "manufacturers and vendors of Information Technology and Information Systems tend to focus primarily on technical issues for solving the 'information' problems in developing nations. In reality, the most urgent problems are not technical, but concern the management of this technology" (Bjørn-Andersen *et al.* 1990:16). This technological conceptualization of IS is also favored by most supporting donors and sometimes by the organizations themselves. The technology side, especially the hardware is tangible and can enable the donor agency to easily win political influence of an organization which they support (Baark and Heeks 1999). In turn, the organizations fight to acquire the same political influence within the public.

This makes the problem of IS development, implementation and use more severe in developing countries. Several other issues also affect the development process, including the current state of knowledge, availability of suitable tools and infrastructure, lack of financial resources, shortage of technically competent personnel and constraints imposed by the social and political context (Walsham *et al.* 1988). The poor information culture is also a big problem in many developing countries. The challenge therefore remains, even if we manage to develop a good information system collecting quality data and generating proper information, how do we use the information generated? Many studies demonstrate this problem, including Simwanza and Church 2001 (Zambia), Chaulagai *et al.* 2001 (Malawi) and Khemrary 2001 (Cambodia).

The study and development of HIS should therefore also consider this problem together with other economic and political factors firmly embedded and affected by

the social, political and economic histories of the countries. Lippeveld and Sapirie advise a successful way of designing and implementing HIS, by arguing that "the success of a health information systems reform depends not only on technical improvements but also on in depth understanding of political, socio-cultural, and administrative factors" (Lippeveld and Sapirie 2000:249).

2.3 Information Infrastructure

Healthcare organizations are complex with different actors having varying information needs. An effective information system to support any healthcare organization is in no doubt a shared resource that evolves over time. Information systems of this nature are more likely to be described as infrastructures rather than as normal traditional information systems, which are typically closed systems, developed within a closed time frame, for a homogeneous group of users and tailor-made for a specific problem (Hanseth, 2002). An alternative approach, Hanseth and Monteiro (1998) argue, comes from the information infrastructure theory. According to them "infrastructures are considered as always already existing; they are never developed from scratch. When designing a new infrastructure it will always be integrated into and thereby extending others or it will replace one part of another infrastructure" (Hanseth and Monteiro, 1998:13).

2.3.1 Conceptualizing Information Infrastructure

Information Infrastructure is more than just the physical facilities that are used to transmit, store, and process information. It is a vast field, covering all kinds of technologies and all kinds of use and use areas. "It involves lots of political, social, organization, human aspects and issues - from the development of industrial at national, regional (EU), or even the global level within the G7 forum to the micro politics in the everyday activities between people involved in the design and use of the technology" (Hanseth and Monteiro 1998:7). The concept has its origin from the traditional concept of infrastructure. In *Webster's Dictionary*, an infrastructure is defined as:

> A substructure or underlying foundation; esp., the basic installations and facilities on which the continuance and growth of a community, state, etc. depends as roads, schools, power plants, transportation and communication systems, etc.
>
> (Gurlanik 1970)

This definition describes an infrastructure as a shared resource, or a foundation, for a community. Therefore, "establishing a working information infrastructure is a highly involved socio-technical endeavor" (Hanseth and Monteiro 1998:8). Several aspects that show the differences between infrastructures and other information systems characterize infrastructures; infrastructures are shared, evolving, open, standardized, and heterogeneous installed bases (Hanseth 2002). Not all systems fit with this definition of information infrastructure. Therefore, our concept of system should not be replaced by that of infrastructure, rather the infrastructure concept is needed in addition to that of system. Systems have to be seen as part of larger infrastructures

and the strategies for developing them have to be implemented in the way they become parts of infrastructure (Hanseth 2002). These key aspects of information infrastructures (as discussed by Hanseth and Monteiro 1998:40-49) are described below.

Infrastructures are enabling, shared and open

Infrastructures have a supporting or *enabling* function in the sense that they are designed to support a wide range of activities, and that they are technologies intended to open up a field of new activities, not just improving or automating something existing. This is opposed to being especially designed to support one way of working within a specific application field.

An infrastructure is *shared* by a larger community in the sense that, it is the one and the same single object used by all of the community (although it may appear differently). Infrastructures are not like traditional information systems that are viewed as individual tools that are developed for specific purposes and local processes, and are used by a limited and homogeneous group. When one module (application) is integrated with others through information exchange, the other modules become dependent. In this way infrastructures should be seen as irreducible; they cannot be split into separate parts being used by different groups independently.

Infrastructures are *open* in the sense that there is no limits for the number of users, stakeholders or vendors involved, nodes in the network and other technological components, application areas or network operators. This implies that one cannot draw a strict border saying that there is one infrastructure for what is on one side of the border and others for the other side, without relevant connections. However, this does not necessarily imply the extreme position that absolutely everything is included in every information infrastructure. Unlimited numbers of users, developers, stakeholders, components and use areas imply several activities with varying relations over time, varying constellations and alliances, changing and unstable conditions for development, and changing requirements. In sum, all this implies heterogeneity.

Heterogeneity

Information infrastructures are more than “pure” technology; they are rather *socio-technical networks.* They include actors, knowledge, use situations and procedures around them. Infrastructures are *heterogeneous* concerning the qualities of their constituencies. They encompass technological components, humans, organizations, and institutions. They are also *heterogeneous* in the sense that the same logical function might be implemented in several different ways. Heterogeneity can occur in several forms, for instance, when one standardized part is being replaced by a new one, when large infrastructures are developed by interconnecting two existing ones, or when larger infrastructures are built based on existing, independent components.

Installed base

Building a large infrastructure takes time, and as time goes by, the infrastructure has to adapt to the new requirements that occur. Since the whole infrastructure cannot be changed simultaneously, the new infrastructure must be designed in a way that it can be linked to the old one. In other words, infrastructures are never developed from scratch, but rather developed by interconnecting and interrelating existing components, called the *installed base*. The installed base comprises the existing systems, work process, users and organization procedures that govern the overall processes. Consequently, the present installed base carries heritage from (and is affected by) the former installed base. Depending on the size, the degree of heterogeneity, and the degree of flexibility, the installed base can affect an infrastructure with a tendency to towards inertia.

The focus on infrastructure as *installed base* implies that infrastructures are considered as always already existing, they are never developed from the scratch. When 'designing' a 'new' infrastructure, it will always be integrated with or replace a part of a later one. This implies that infrastructures are developed through the extension and improvements of the *installed base*. The installed base is important due to its characteristics of being uncontrollable and influencing the evolution of the infrastructure. It is uncontrollable in the sense that no actor alone can have total influence upon it, although several actors have limited influences upon it (Hanseth 2002). One reason for its uncontrollable characteristics is that, the elements are entangled in each other, that is, there is a high degree of interconnectivity between them.

2.3.2 Health Information System and Health Information Infrastructure

Investigating any HIS, one can realize the following:

- HIS are enabling for new processes and supporting a wide range of functions, not all decided when deployed.
- HIS support information-sharing among a large community of different users with different needs, within and outside the healthcare organizations.
- HIS is a part of a large heterogeneous socio-technical network encompassing humans, technological components and institutions.
- When developing HIS, the new systems must respect the installed base, that is, the already existing reporting procedures, systems, technologies and users.
- There is high degree of interconnectivity within HIS, everything is connected and interrelated.

This is in contrast to the system characteristics of closeness, developed within a closed time frame, for a homogeneous group of users and tailor-made for a specific problem (Hanseth 2002). Even if HIS do not have all characteristics possessed by the large infrastructures like the Internet, they still have most of them. Hanseth and Monteiro (1998) state that there is no clear-cut definition for information infrastructures, and that there are different kinds of infrastructures (global such as Internet, sector and corporate). In that respect, they state that the web of closely

integrated systems in large corporations does not fit the systems notion. This concept can therefore be applied to the healthcare sector, that is, conceptualizing HIS as health information infrastructure rather than as a traditional health information system. The primary reason for using information infrastructure theory is to elaborate the complexity related to the development process for the new HIS.

2.3.3 Actor Network Theory

Actor Network Theory (ANT) is one theory that can be used for understanding information infrastructures, since it provides a framework for unpacking the complexity related to the socio-technical nature of the information infrastructures, viewing the technology as an actor along with other actors. ANT views human and non-human, technical and non-technical as linked elements in the networks, and it focuses on the relations and interplay between these elements, rather than on each actor separately. When viewing information infrastructures through the lens of ANT, they can be seen as large actor-networks, including existing systems, technologies, work procedures, users and so forth. ANT considers all these 'things' and 'acts' together; accomplishing what is termed as an 'actor-network'. An actor-network, then, is the actors linked together with all of its influencing factors (which again are linked), producing a network (Monteiro 2000). An actor can be human or a collection of humans, texts, graphical representations, and technical artefacts and all have different interests, trying to convince other actors so as to create an alignment of the other actors' interests with their own.

Monteiro (2000) explains the complexity of the ability of different actors to translate, that is, re-interpret, re-present or appropriate others' interest to one's own interest. Various actors within an organization may be involved in different processes of *translation*, each with its own unique characteristics and outcomes. According to Monteiro (2000), design is *translation*; 'users' and others' interests may, according to typical models be translated into specific 'needs'; the specific needs are further translated into more general and unified needs so that these needs might be translated into one and the same solution. When the solution 'system' is running, the users will adopt it by translating the system into the context of their specific work tasks and situations (Monteiro 2000).

Inscriptions

One key concept in actor network theory is that of 'inscriptions'. "The notion of inscription refers to the way technical artefacts embody patterns of use" (Hanseth and Monteiro 1998:98). The concept explains how designers assumptions about the future use of a technology, described as programs of action, is inscribed into its design. "Whether the technology in fact will impose its inscribed program of action depends on to what extent the actual program of action is also inscribed into other elements, for instance documentation, training programs, support functions, etc." (Hanseth and Monteiro 1998:12). "Inscriptions are given a concrete content because they represent interests inscribed into a material. The flexibility of inscriptions varies, some structure the pattern of use strongly, others weakly" (Hanseth and Monteiro 1998:99). The strength of inscriptions, whether they must be followed or can be

avoided, depends on the irreversibility of the actor-network they are inscribed into. Callon (1991) states that the degree of irreversibility depends on (i) the extent to which it is subsequently impossible to go back to a point where that translation was only one amongst others and (ii) the extent to which it shapes and determines subsequent translations (Callon 1991 cited in Hanseth and Monteiro 1998:100). "It is never possible to know before hand, but by studying the sequence of attempted inscriptions we learn more about exactly how and which inscriptions were needed to achieve a given aim" (Hanseth and Monteiro 1998:99).

2.4 Changing the Information Infrastructure

Hanseth and Monteiro (1998:193) describe three generic strategies for changing an information infrastructure:

- An evolutionary one: a slow, incremental process where each step is short and conservative;
- A more daring one: a faster process where each step is longer and more daring; and,
- A radical one: fast changes, which are a radical break with the past.

The daring and radical strategies are difficult to implement due to the role and nature of the installed base and network externalities. The rewards of switching to the new system, which no one is using, are small and everyone is waiting for others to switch. Though there are some success stories of the daring strategy illustrated by e-mail users subscribing to America Online that "jumped" to Internet in a single day. Another example is changing the Norwegian telephone system in 1994 from 6 to 8 digit numbers, done by the Norwegian Telecom who at that time enjoyed a monopoly status (Hanseth and Monteiro 1998). Radical changes mostly happen in case of chaos of dramatic crises (like the oil crises in the early 70s) or in case of some external shock (Hughes 1987 cited in Hanseth and Monteiro 1998).

Considering the nature of HIS, one can note that it is not possible to "jump" from an old system to a new system on a "flag day". Therefore, an evolutionary approach seems to be the most appropriate. The evolutionary strategy consists of changing a small part of the network, and then making sure the newly added parts work properly. Then move on to change the next small part. This means that the change is spread out over time, each step being small, thereby aligning the network of actors. This strategy has an advantage of reducing the possibility of failure as Heeks (1999) points out, the higher the degree of change, the higher the chance of failure (Heeks 1999). An evolutionary approach has an emphasis on the installed base, that is, the need to grow slowly, and that the new systems should work like the rest. This leads us to explore further for a more realistic ways to intervene, i.e. design, an information infrastructure. This implies a closer analysis of the way behaviour is inscribed in the installed base, rather conceptualizing the design process as "cultivation" (Hanseth and Monteiro 1998; Hanseth 2002).

2.4.1 Cultivation

The concept of "cultivation" turns our focus on the limits of rational, human control on the design process; seeing the installed base both as a material to be shaped (improved and extended), at the same time as it is an actor that often appears to live a life of its own outside the control of designers and users (Hanseth 2002). "The installed base also acts as a "designer" in two ways. It may be considered an actor involved in each single information infrastructure development activity, but perhaps more importantly, it plays a crucial role as mediator and coordinator between the independent non-technological actors and development activities" (Hanseth and Monteiro 1998:160).

Cultivation can also be used in the adaptation process, where a careful analysis of the existing system can help the new system to be better aligned with the installed base. This however, requires that the new system is flexible. Cultivation also deals with the political process of negotiations and brokering between actors at multiple levels in an organization. HISP refers to the continuous process of defining standards for healthcare in South Africa as cultivation. As Braa and Hedberg (2002) put it:

> By cultivation, we mean a slow, incremental, bottom-up process of aligning actors by enabling translation of their interests and gradually transforming social structures and information infrastructures where the resources already available form the base. The precise outcome of the design process is not given, but is negotiated within a broader set of goals.
>
> (Braa and Hedberg 2002:116)

Two challenges are encountered when developing new infrastructure or changing the existing ones. First, how to get a self-reinforcing process started that will enable the installed base to start growing. Second, when infrastructures start growing, it might lead into a lock-in situation (Hanseth 2002). The challenge is how to prevent entering into a lock-in, and how to exit from a lock-in once entered.

To prevent the lock-in situation, Hanseth (2002) suggests the design of the infrastructures to be flexible in terms of use and change. The use flexibility refers to the way information infrastructure can be used in many different purposes, and the change flexibility refers to how easily the infrastructure can be changed, that is, by replacing one version of a standard with another. However, replacing a working version with another may be very difficult as changes may introduce some kind of incompatibility that may cause a lock-in situation. Use and change flexibility are interlinked in the sense that increased use flexibility decreases the need for change flexibility and vice versa. In general, there are two elements necessary for developing flexible information infrastructures. First, the standards and information infrastructures themselves must be flexible and easy to adapt to new requirements. Second, strategies for changing the existing information infrastructure into the new one must be developed together with necessary gateway technologies linking the old and the new (Hanseth 2002).

2.4.2 Participatory systems development

Successful development of the information infrastructure requires involvement of the users of the system, as they are very important actors in the design and deployment process. Drawing from actor network theory, Hanseth and Monteiro (1998) describe users as designers, since they influence the way the technology is deployed. When the developers are close to the users and consult with or involve them in the construction and trial stages, the network into which the intended user behavior is inscribed will be stronger and accordingly harder for the users not to follow it (Hanseth and Monteiro 1998). User participation may also lead to a more flexible use of the technology.

User participation in information systems design, originates from Scandinavia, later spread around Europe (Ehn 1993 cited in Puri *et al.* 2004). The approach is also used in the USA (Gregory 2003). The approach is now in use in developing countries such as South Africa, Mozambique, Tanzania, India and Malawi through the Health Information System Project (HISP) first initiated in South Africa in 1994 and later to other countries.

User participation aims at involving future users of a system in decisions during the system's development; the main reasons being to enable them develop realistic expectations and to improve the knowledge upon which a system is being built (Bjerknes and Bratteteig 1995). Greenbaum and Kyng (1991) claim that involving users on design process can help in the selection and better understanding of the problem, and this will lead to the mutual learning between the users and designers about their respective fields by providing same perspectives of work.

However, how users should be involved also depends on the context. For example, the Scandinavian approach of participation is highly motivated by deep commitments to democracy and democratization (Gregory 2003). This approach assumes a democratic culture, a typical feature of Scandinavian culture, or at least a western culture. In most developing countries, this is not the case. Therefore, user participation in this case needs to be adapted within the present political, socio-cultural and economic contexts. Puri *et al.* (2004) explain this contextuality in the process of information system design in three different counties; in India where the participation recognized the Indian hierarchical settings; in South Africa where it was mainly relied in the culture and tradition of the community involved; and in Mozambique where the approach emphasized the role of mediating agency (academia) in bridging the gap between top and bottom.

2.4.3 HISP experience in systems development

Health Information System Project (HISP) is a collaborative research and development program between universities and ministries of health in several countries. HISP was established in South Africa in 1994 and later spread throughout other countries including Mozambique, India, Tanzania, Ethiopia, Malawi, Mongolia, Cuba, Nigeria and China (Braa *et al.* 2004). The HISP vision is to "support the

development of an excellent and sustainable health information system that enables all healthcare workers to use their own information to improve the coverage and quality of health services within our communities" (HISP website, accessed April 18, 2005).

Thus, the primary goal of HISP is "to design, implement, and sustain HIS following a participatory approach to support local management of healthcare delivery and information flows in selected health facilities, districts, and provinces, and its further spread within and across developing countries (Braa *et al.* 2004:343). HISP focuses on the process towards developing standards for primary healthcare data, and how this process can be related to the design and development of a District Health Information Software (DHIS). HISP emphasizes on the bottom up empowerment and training of local health workers to use data, establish routines and procedures for handling information at health facility and district levels. The project acknowledges the importance of scalability and sustainability, thereby institutionalising the processes so that the changes introduced work and evolve after the researchers leave (Braa and Hedberg 2002).

Despite the challenges which the project faces, the project is successful in the diffusion of lessons and software product (DHIS), starting from few districts in South Africa to become South African standard, and later used in several other countries, through the processes of adaptation and appropriation (Braa and Hedberg 2002). The lessons learned in the HISP birthplace, South Africa, were the improved linkages and efficient communication between users and professional software developers. The use of the off-the-shelf software that DHIS allies with, that is, Microsoft Excel and Microsoft Excel pivot tables enabled managers analyze the data using the tools that are available and that they have enough experience with them. This in turn maximizes data use at the local levels. The use of such tools also reduces the development time that will be required to reproduce this functionality in their application (Wilson *et al.* 2001a). The implementation processes of the DHIS software became a vehicle for change, including standardization, integration, and more widespread dissemination of health data and information (Braa and Hedberg 2002). The indicator-based approach to determining information needs is an effective way to reduce the number of data elements collected and to ensure that data collected is relevant (Braa and Hedberg 2002). Despite the differences in the organization structures, scale and culture, the other developing countries learned and continue learning from these lessons from South Africa. The countries can also learn from each other's experience.

2.5 Chapter summary

In this chapter, literature review and theoretical and conceptual framework have been discussed. The literature review presents the current situation of HIS in developing countries. The literature shows that HIS in most developing countries are under-performing. Several problems are associated with the existing HIS including the problems of data quality, poor infrastructure and inadequate resources,

centralization and fragmentation of HIS, and the problem of information culture. Many developing countries have attempted to implement IT as a means to improve the efficiency of their HIS. The adoption of the technology is a challenge considering the context of the developing countries and in the health sector in particular. Several issues impede changes including the existing poor infrastructure, lack of required skills among the health workers on the use of technology, the existing procedures of data collection, processing and reporting, and the information culture.

New HIS have been introduced in many developing countries, but most of them ended with either partial or full failure. This is because the developers emphasized only the technical aspects and overlooked social and organizational factors that influenced the development process. The 'ITPOSMO' model of conception-reality gaps (Heeks 1999) is used to explain more about why this happens, and how the risks of failure may be reduced. The model identifies three typical broad categories of conception-reality gaps. These are rationality-reality, private-public, and country gaps. Of the three categories of gaps, rationality-reality and the country gaps are more important for the discussion in this thesis. These will be used to analyze how the rationality imposed on the development of the DHIS software can be aligned with the current situation in the healthcare organization in Zanzibar, and how software designed and developed in South Africa can be adapted to the context of Zanzibar.

Based on the concept of social system perspective of information system (Walsham *et al*. 1988), I have conceptualized HIS as socio-technical systems. This is because an HIS cannot be understood independently of the people around it, their social relationships, their culture and the work practices in which they are engaged within everyday life. The study of HIS involves the study of this complex interlinking between the different people, the technology and the material artifacts, the organizations and the organizational settings. The concept is used to discuss the current situation of HIS in Zanzibar.

The development process is viewed from the information infrastructure perspective, specifically the role of installed base in the development process. The study acknowledges the socio-technical complexity of the HIS imposed in the development process, analyzed using Actor Network Theory (ANT). Inscriptions are given special emphasis regarding their ability to affect further development of the infrastructure. The development process has been conceptualised as cultivation. The concept of cultivation turns our focus on the limits of rational, human control on the design process; seeing the installed base both as a material to be shaped (improved and extended), at the same time as it is an actor that often appears to live a life of its own outside the control of designers and users (Hanseth 2002). User participation for systems development has been discussed and advocated for the development of the new infrastructure. The main assumptions are that, involving future users of the system helps to enable them develop realistic expectations and to improve the knowledge upon which a system is being built (Bjerknes and Bratteteig 1995).

3
Research settings

In this chapter I describe the research settings where I have conducted my research. This research was conducted in Zanzibar. The situation analysis of Zanzibar is presented in section 3.1 where the country's political history, geography, demography, education and socio-economic profiles and the present health status are included. In section 3.2, I present the organization of healthcare system in Zanzibar. After finishing reading this chapter, the reader will have an overview of the settings in which the case findings are presented in chapter 5 and chapter 6.

3.1 Situation analysis of Zanzibar

In this section, I briefly describe the situation analysis of Zanzibar to show the country's historical and existing situation. The following aspects are described: (1) the political history and the current administration system to show the relationship of the current system of administration in Zanzibar related to Tanzania, in order to show how the public healthcare services are connected to the current administrative structure. (2) Geography, demography, state of education and socio-economic profiles. These have direct impact to the delivery of healthcare services, for example the economic status influences the quantity and quality of services delivered and the general healthcare management.

3.1.1 Political history of Zanzibar and the current administrative system

Zanzibar is a country that is part of the United Republic of Tanzania. Zanzibar became independent in the 10th of December 1963. The People's Republic of Zanzibar was established after the revolution of January 12, 1964. Soon after this revolution, Zanzibar joined with the former Tanganyika in April 26, 1964 forming what is now known as the United Republic of Tanzania. Even though Tanganyika surrendered all her authority of sovereignty to the Union, Zanzibar remained semi-autonomous with the Zanzibar Government assuming some administrative responsibilities for the people of Zanzibar, including those related to healthcare services delivery. The Zanzibar administration comprises the Executive, Legislative and Judiciary branches. The Zanzibar President who is also the Chairman of the Revolutionary Council, heads the Executive branch. Each ministry has a headquarters in Unguja and a head office in Pemba in order to simplify the administrative activities between the islands. The official languages are Swahili and English, though Swahili which is the mother tongue of all Zanzibaris is spoken more in almost all places including the work places.

3.1.2 Geography

Zanzibar is made up of two main islands, Unguja and Pemba, and several others islets located in the Indian Ocean, a few miles to the east of the Mainland Tanzania coast. Zanzibar has a total area of 2,332 square kilometres (of the total of 945,000 of Tanzania), and is divided into five administrative regions, each with two districts. Zanzibar Town is the capital of Zanzibar. Chake Chake is the unofficial capital of Pemba Island with most government ministries having their head offices there. However the Ministry of Health has a head office in Wete with some vertical programmes having their offices in Chake Chake. Figure 4.1 shows the position of Zanzibar in Tanzania and figure 4.2 shows the map of Zanzibar.

Figure 3.1: Map of The United Republic of Tanzania showing position of Zanzibar

Figure 3.2: Map of Zanzibar.
Note: The map does not show the administrative divisions.

3.1.3 Demography

According to the Tanzania National Population and Housing Census of 2002, Zanzibar has a population of 984,625 (of total Tanzania population of 34,569,232). The average annual intercensal growth rate is 3.1% a year from the 1988 to 2002 census. 44.3% of the population are under 15 years. Zanzibar has a high population density of 400 people per square kilometre.

3.1.4 The state of education in Zanzibar

Primary and first cycle[1] lower secondary education is compulsory in Zanzibar. There are a reasonable number of schools and adult education programmes but still the illiteracy rate is high at 40% recorded in the year 2000 (MOFEA 2002). The net enrolment rate has been improving well from 59.6% in 1995 to 81.6% in 2000

[1] Two years of secondary education after seven years of primary education.

(MOFEA 2002) and the government declared to reach 100% in 2004. The government owns most schools but private institutions and non-governmental organizations are currently also working in the education sector.

3.1.5 Socio-economic profile

Zanzibar's major economic sectors include agriculture, trade and industries, and tourism. Agriculture is the mainstay of the economy largely due to the government-controlled clove industry, which is the main foreign currency earner. Historically, trade has been second to agriculture but many years of isolation and the socialist policies adopted after the 1964 revolution have completely undermined its potential in Zanzibar economy. Recently, tourism has emerged as a possible successor to the ailing clove industry. Zanzibar as a part of the United Republic of Tanzania, is currently ranked as one of the poorest countries in the world.

3.1.6 Health sector performance

The current healthcare system in Zanzibar is based on the post-revolution health sector policy, in which the government declared free healthcare access to all Zanzibaris with an emphasis on disadvantaged groups in the rural areas particularly, and all poor women and children. Due to the implementation of the policy, the health infrastructure was improved and currently the majority (100%) of Zanzibar people live within 10 kilometres of healthcare facilities and 95% of Zanzibar people live within 5 kilometres walking distance to a health facility (MOHSW 2002a). The policy worked very well within the first few years up to the late 1980s. However the economic downturn that Zanzibar faced in the mid-1980s, together with reduced direct donor support in the mid-1990s, left the government unable to adequately support the public health sector despite the good healthcare infrastructure that the islands enjoy.

Since the mid 1990s, the public health sector performance has been declining dramatically in both the quantity and quality of services. This loss is reflected in the reduction of the per capita visits to a health facility from 2.11 in 1995 to 0.95 in 2001 (MOHSW 2002b). Still the sector is facing high burdens of diseases, indicated by the high Maternal Mortality Rate (MMR) estimated to be 314 per 100,000 live births, high Infant Mortality Rate (IMR), which was estimated to be 75.3 per 1000 live births in 1998, and increased morbidity for perceptible parasitic infectious diseases such as malaria which alone constitutes 35% of all outpatient cases reported (MOHSW 2002b).

In the late 1990s, the Zanzibar government allowed the establishment of private hospitals and clinics. However, the implementation was mainly in towns and many of the poor cannot afford to pay for the services. As a part of efforts to improve the current situation, the Ministry has adopted the Health Sector Reform strategies as its rational process to increase efficiency in the healthcare sector. The reform is also emphasised in the Zanzibar Poverty Reduction Plan (MOHSW 2002b).

3.2 Organization of the healthcare system in Zanzibar

Public healthcare services in Zanzibar are organised and offered by the Ministry of Health and Social Welfare (MOHSW), hereafter called the Ministry of Health (MoH). The structure of the Ministry of Health is shown in figure 3.3. The healthcare system is organised in three levels: primary, secondary and tertiary. In practice the higher level healthcare institution can also provide the lower levels care; that is the tertiary hospital can also provide the secondary and primary healthcare services and the secondary healthcare institution can also provide primary healthcare services, primarily based on the proximity of the population. Primary healthcare services are under the Department of Preventive Services while the secondary and tertiary healthcare services are under the Department of Curative Services. This study focuses on the Primary Health Care (PHC). The primary healthcare system is organised under the Department of Preventive Services as shown in figure 3.4.

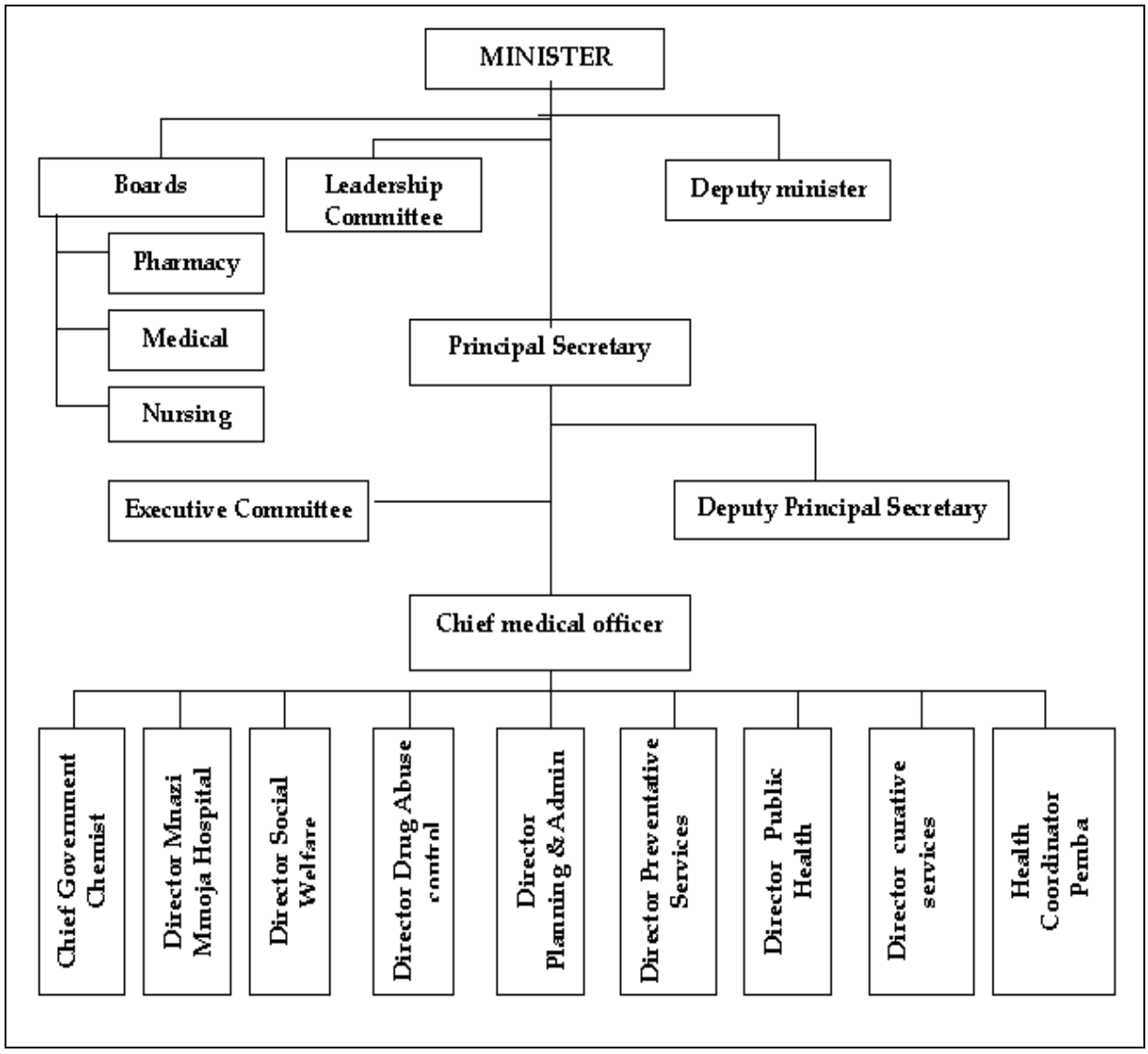


Figure 3.3: Structure of the Ministry of Health. Source: Field visit in Zanzibar to the Ministry of health headquarters August 2003.

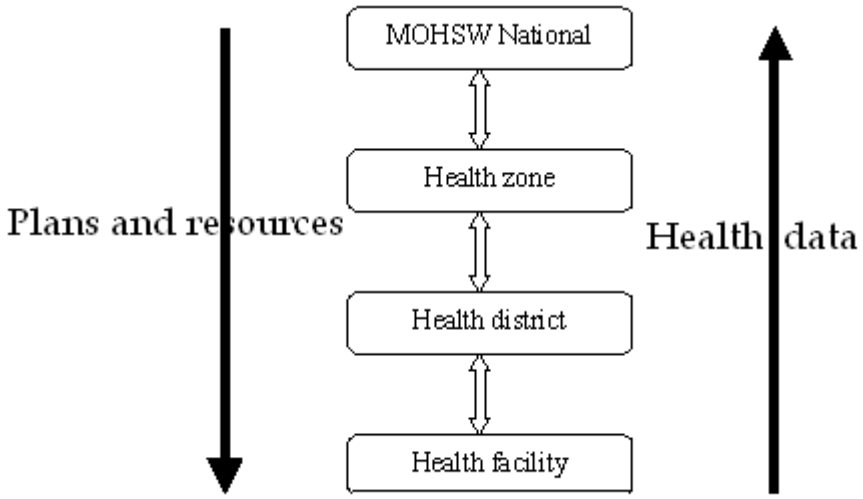


Figure 3.4: Organization of Primary healthcare services in Zanzibar. Source: Field visit in Zanzibar to the Ministry of Health headquarters, August 2003.

3.2.1 Primary Health Care (PHC) services

Zanzibar is divided into two health zones, Unguja and Pemba, which are then divided into health districts that are the same as the administrative districts. Unguja Zone has six health districts: Urban, West, North 'A', North 'B', Central and South. Pemba Zone is divided into four health districts: Micheweni, Wete, Chake Chake and Mkoani. A Zonal Health Management Team (ZHMT) administers each zone, which is responsible for overseeing all health activities within the zone with the exception of tertiary healthcare services. Every District Health Management Team (DHMT) is responsible for overseeing a particular health district.

The structure of DHMT is the same as ZHMT. Each team comprises six officers (district or zonal officers) and can also have co-opted members[2] who are responsible for supporting the team in some issues. The officers include:

1. District / Zonal Medical Officer (DMO / ZMO) who is also the head of the DHMT / ZHMT.
2. District / Zonal Health Administrative Officer responsible for the overall administrative works within the district.
3. District / Zonal Public Health Officer.
4. District / Zonal Public Health Nurse.
5. District / Zonal Health Materials Manager responsible for management of medicines and other medical and non-medical supplies.
6. District / Zonal Financial Officer.

The primary healthcare services are divided into three levels depending on the capability of the healthcare facility (HCF):

1. Primary healthcare unit (PHCU) 1st line: These are healthcare facilities with normal clinical investigation but which cannot do laboratory diagnosis or provide dental care services.

[2] Staff who are not members of the team appointed to help the team.

2. Primary healthcare unit (PHCU) 2nd line: These are health facilities capable of doing both clinical investigation and laboratory diagnosis as well as providing dental care services.
3. Primary healthcare centre (PHCC): These are cottage hospitals capable of providing more services including minor operations and X-ray services. Currently there are four cottage hospitals, two on each island.

3.2.2 Secondary healthcare services

These are the district hospitals, which are the second referral level from the primary healthcare level. The district hospitals are capable of performing major operations and some have specialised doctors. However, the district hospitals are located on Pemba Island only, where there is three district hospitals: Abdulla Mzee Hospital at Mkoani, Chake Chake Hospital and Wete Hospital.

3.2.3 Tertiary healthcare services

These services are only available on Unguja Island at Mnazi Mmoja Referral and Teaching Hospital. The hospital incorporates Mwembeladu Maternity Home and the Mental Hospital, which are located in different sites from the main site. The hospital provides referral services for the whole population of Zanzibar and also provides the secondary healthcare services for the Unguja Island.

3.3 Organization of HIS in Zanzibar

At the time of this study, the information system for the public health sector in Zanzibar was still paper-based, not well organized and mainly shaped by the organization of the vertical programmes services. However, during that time the Ministry of Health was in the process of implementing health sector reform, which among other things, targets at decentralization and improvement of HMIS whereas major revision to the existing HMIS is on the process. In this revision all data collection forms have been re-designed and are being prototyped in two pilot districts. The Ministry also was keen on finding a software solution for the new HMIS.

4
Research methods

In this chapter, I present the methods used for data collection and analysis. This study is not only meant to study the existing HIS but also to bring about changes to improve the situation and therefore action research methodology was used. The initial study of the existing HIS was carried in the form of a case study research approach, where qualitative research methods were used. Action research approach was used regarding the process of introducing changes. The chapter is arranged as follows. Section 4.1 presents brief introduction followed by the research design in section 4.2. The research approach and methods used are presented in sections 4.3 and 4.4 respectively. Finally, I present the sections on validity and reliability of the research, ethics and study limits in sections 4.5, 4.6 and 4.7 respectively.

4.1 Introduction

The research focused on the study of the health information system at the local level aiming at exploring the procedures and tools used to collect, store and analyse routine data and reporting procedures, identifying problems related to the current information system in order to inform 'prototyping' of DHIS software for its adaptation to Zanzibar's healthcare system and context, as an alternative solution to the existing paper-based information system. The study falls under the framework of an action research paradigm, where a participatory action research methodology was adopted. Qualitative research methods were used. A case study approach was adopted for the field research in the healthcare system, where two cases of healthcare practices in two different districts were selected.

4.2 Research design

In this research, a longitudinal case study approach was used where two cases from two different districts were studied and compared. The two districts are North 'A' on Unguja Island and Micheweni on Pemba Island. HIS cannot be separated from the other work processes related to healthcare service provision, the procedures and norms, the people and the institutions. HIS are socially constructed and complex in nature, for example there is no boundary between HIS and healthcare services provision and both are also influenced by several other factors in healthcare organizations. Case study research is a very good approach for bringing an understanding of a complex issue, as it emphasizes detailed contextual analysis of a limited number of events or conditions and their relationships. Therefore, a case study approach seemed to be more feasible for the study conducted. Yin (1984) defines case study research as "an empirical inquiry that investigates a contemporary

phenomenon within its real-life context; when the boundaries between phenomenon and context are not clearly evident; and in which multiple sources of evidence are used" (Yin 1984:23).

The selection of the districts and HCFs was based on the following criteria. North 'A' district is the Ministry's pilot district for the implementation of the decentralized health management system where the new HIS is being prototyped. The district is also a pilot area for many donor-supported projects. Micheweni district is similar to North A district in life standard, that is both are rural districts characterised with low income. However, it is located on another island meaning that it is far from the Ministry headquarters and is not linked to many donors. Therefore, I wanted to compare two districts that are similar in life standards, but one with more support from the Ministry and donors than the other. Micheweni district is also my home district and I had already established a contact with the district administration prior to the research.

On both islands, I visited District and Zonal Health Offices and three HCFs including one cottage hospital in each district. My selection of cottage hospitals was based on the fact that they are better equipped and financed, and are closer to the District Health Offices compared to the other HCFs in their respective districts. However, the selection of the other HCFs was mainly based on how easily I could access them in terms of transport. This selection was also backed up when I realized that the DHMTs are responsible for the distribution of all supplies and that all HCFs in the two districts can be reached by car except for the two HCFs located on an islet, hence transport was not a very important factor to consider for the HCFs. I also visited the Ministry Headquarters and the Ministry's Statistics and Epidemiology Units. I also had opportunity to visit some vertical programmes' offices, including Safe Motherhood Programme, Extended Programme of Immunization (EPI), Nutrition Unit and Malaria Programme, when I was participating in the joint consultancy team in December 2004 (see chapter 7). As a whole, the field research was conducted between late July and December 2004.

4.3 Research approach

This study aimed to both academic purposes and to bring changes to the overall health management information system at the Ministry of Health. For these purposes, action research proves to be a very good approach. Baskerville (1999) describes action research to be "grounded in practical action, aimed at solving an immediate problem situation while carefully informing theory" (Baskerville 1999:3).

In this research, I deployed a special form of action research, participatory action research. In participatory action research responsibilities are shared between the researcher and the participants, that is, instead of leaving the responsibilities to the researcher only, those who 'own' the problem are also involved in selecting problems and searching for solutions (Elden and Chisholm 1993). Health service providers and officers here are the owners of the problem to be studied. Their participation as the

main informants gave me enough knowledge on what exactly is being done within HIS and the general healthcare system. Based on this, I could then suggest appropriate IS solutions towards the identified problems. The two parties, that is, the researchers and the practitioners discussed any suggested solution; hence there was mutual learning (Elden and Chisholm 1993).

My original plan was to adopt the five phase cyclical approach described in Baskerville (1999). I started with the diagnosis phase thereby identifying the problems. The diagnosis phase is mainly represented in the case studies (see chapter 5 and chapter 6). The next phases of planning and implantation were mainly determined by the readiness of the Ministry. The planning phase was in the first week of December 2004 followed by a short period of two weeks for implementation. However, a plan for the next cycle of the research (which is beyond this thesis) has been already prepared.

4.4 Research methods

Within the action research framework, different tools and methods can be used depending on the study context. I chose qualitative methods for understanding the complexity of the system and the situation at the healthcare facilities and other health offices. My concern was to deeply understand 'how' the system works and 'why' it works that way (Anderson and Aydin 1994). By exploring the experiences of those who work within the healthcare sector, I aimed to explore the procedures and tools used to collect, store and analyse routine data and the reporting procedures and to identify problems related to the current information system. I also aimed to understand how the DHIS software could be "prototyped" for its adaptation to Zanzibar's healthcare system and context in order to provide a software solution for the identified problems. Therefore, my data were primarily 'words' rather than 'numbers', and 'words' can better be analysed in qualitative methods.

Within this context, qualitative methods can better explore the case. In qualitative research, the researcher usually tends to "stress the socially constructed nature of reality, the intimate relationship between researcher and what is studied, and the situational constraints that shape enquiry" (Denzin and Lincoln 1994:4). The methods used are believed to "provide a 'deeper' understanding of social phenomena than would be obtained from purely quantitative data" (Silverman 2001:32).

Quantitative methods, on the other hand, can provide better comparisons for statistical aggregation of data. Typically quantitative methods are more useful in a situation where closed questions with *yes* or *no* answers or *a set of predefined* answers can be used. To properly answer my research questions, quantitative methods would be less useful.

To achieve significant and complete case studies, three main research methods were used for the data collection process, including ethnographic interviews, observation and participant observation, and document analysis. Literature review and the

review of official documents were also conducted in addition to the three main methods. A multi-methods data collection approach can better provide sufficient evidence on what the study explores.

4.4.1. Ethnographic interviews

I started my field research with ethnographic interviews in all my field sites. The aim of the interviews was to elicit the individual health staffs' experience on the way the HIS works. How primary healthcare data are being collected, stored, analyzed and used and how the reporting procedures operate. Also to identify problems associated with the HIS as well as to get the staff's suggestions on how to improve the current situation. With this aim, I opted for open-ended semi-structured interviews. Open-ended interviews give more freedom to both interviewer and interviewee to ask and give further elaborations, and provide a better way to obtain authentic understanding of people's experience (Silverman 2001). One problem I came across with interviews was that some interviewees could not explain the problems they have rather they could explain only what they have achieved, the case of which I had to clarify through the other methods and then re-interview another time but more carefully. For example, in one case, an interviewee responded only with positive answers for staff and never mentioned any problem, something that was absolutely impossible. When I went back the next week, and showed him some example data, he agreed that there were some problems caused by staff and that he could then explain.

I had interviews with healthcare service providers at the HCFs mainly at Outpatient Departments (OPD) and MCH clinics. I also interviewed some staff at the maternity ward of the two cottage hospitals, health officers at the district, zonal and national levels and traditional birth attendants (TBAs). All interviews were conducted at the respective workplaces, except for a few which I conducted at the places where a particular interviewee was available at that period. My interview guide (see Appendix B) had separate questions for the staff at the national, zonal, district and healthcare facilities levels and also for the TBAs. I usually conducted individual interviews, but in case more than one staff are available in that section at that time, the whole group participated in the interview. All the interviews were conducted in Swahili, the local language. However, I prepared my interview guide in English and I took notes in English in order to easily document my field research, since I would not need to interpret into English. I also used audiotaping in some interviews.

Place	**Number of interviews**
National level	One group interview with three interviewees
Unguja ZHMT office	One individual interview with ZMO
Pemba ZHMT office	One individual interview with ZMO
North 'A' DHMT office	Three individual interviews
Micheweni DHMT office	One individual interview and one group interview with two interviewees.

North 'A' District healthcare facilities	
Kivunge Cottage Hospital	Four individual interviews and one group interview with four interviewees
Mkokotoni PHCU	Two individual interviews
Chaani Masingini PHCU	Three individual interviews
Micheweni District healthcare facilities	
Micheweni Cottage Hospital	Three individual interviews and two group interviews each with two interviewees
Tumbe PHCU	Three individual interviews
Shumba Viamboni PHCU	Two individual interviews
North 'A' District TBAs	No interview conducted
Micheweni District TBAs	Four individual interviews

Table 4.1: Number of interviews conducted at each place. Source: Fieldwork in Zanzibar, July – December 2004.

Follow-up interviews were done in case anything was unclear. Here I usually went to ask the respective interviewee again after the documentation and quick analysis of the original interview. For this purpose, I sometimes used informal interviews by telephone or I could talk to the people even in our normal conversation when we would meet, since I had already built closer contacts and friendship with the people. My interviews took between 30 minutes to 2 hours, depending on the interview environment. I never interrupted the interviewee when giving examples and bringing documents. I sometimes asked them if they wanted to carry on taking care of the patients. I usually took the advantage of these breaks when they were providing services, to observe the work practices and the data collection processes. In total I conducted 32 interviews, where 27 were individual interviews and 5 were group interviews (see table 4.1).

4.4.2 Observations and participant observation

Silverman (2000) argues that extended observation is a better method to really understand what people or a group of people does in their natural work environment. In my study I conducted both planned and unplanned observations. My attention was to understand how people work, how data are being collected and processed in their natural environment, the timings of the activities and the interactions between staff and between staff and clients in relation to data collection and processing. I usually compared what I was told in the interviews and what I saw in the real situation. The unplanned observations provided a better understanding of the real situation, since the observed staff were not in consideration that they were being observed, compared to the planned observations. I usually supplemented my observations with questions to specific staff or I sometimes asked the In-charge of the visited place. The question asked most often was "why are you doing (this), this way?" In addition to taking notes, I also took some important photographs whenever it was possible.

My participant observation sessions were during the time I was working with other Ministry officials to review the new HMIS forms at the Ministry headquarters and in several meetings that I attended. In these meetings, I learned how the health managers considered the importance of information. Participant observations are better for understanding the study environment as Silverman (2001) points out:

> In order to understand the world 'firsthand', you must participate yourself rather than just observe people at a distance.
>
> (Silverman 2001:45)

4.4.3 Document analysis

Documents are very important in collecting qualitative data. Atkinson and Coffey (2000) argue, "If we wish to understand how organizations work and how people work in them, then we cannot afford to ignore their various activities as readers and writers. Moreover if we wish to understand how the organizations function, then we also need to take account of the role of recording, filling, archiving and retrieving information" (Atkinson and Coffey 2000:46). Documents usually give historical insights of the data recorded in the absence of the researcher, that is, the data collected in a natural settings without any influence of the researcher, since when the researcher observes the staff there is a possibility of the staff working more carefully so that s/he does not make mistakes while observed. In my study, I collected and reviewed several documents to confirm what I have been told in the interviews and for comparison with what I observed. The documents include (see Appendix C for samples):

- Different register books, tick sheets and tally sheets
- Several monthly reports, charts, graphs and maps displayed on walls, and
- Examples of quarterly district reports.

4.4.4 Literature review and other secondary sources

In addition to the above research methods, I also used other supplementary methods that are the secondary sources of data for my study. This included attending meetings, where I could learn from what meeting participants presented and discussed. In this study I also went through some official documents and reports prepared at the Ministry of Health and other government agencies. These documents provided me with information regarding the current situation and the government plans in general. The documents include:

- Assessment of Disease Surveillance Activities at District Level, 2004
- Zanzibar Vision 2020
- Zanzibar Poverty Reduction Plan (ZPRP)
- Zanzibar Health Sector Reforms Strategic Plan (2002/03 – 2006/07)
- Zanzibar Health Policy (A summary).
- Government website of The United Republic of Tanzania at http://www.tanzania.go.tz
- Zanzibar Government website at http://www.zanzibargovernment.org

In order to gain more understanding of the context of my study, I conducted literature review prior to, during and after my fieldwork. I aimed to seek knowledge on how to conduct the research, to know the general condition of HIS in similar countries and how other researchers described the problem-solving process in other developing countries.

4.4.5 Fieldwork documentation and data analysis

In this study, qualitative methods were used. I usually took field notes to document the interviews, observations and the content of the documents I analyzed. At the end of each day, I re-organized my field notes comparing the data I obtained from the three methods. This also contributed to the plan for the next day's fieldwork, where I could learn about what was missing regarding my questions. This continuous collection and analysis of data is common in qualitative methods. Agar (1980) explains the process to be inductive and cyclic. Usually you learn something by collecting some data, analyze the data to make sense out of it and then you go back and see if the interpretation makes sense in light of new experience, thereby collecting more data. Then you refine your interpretation by conducting further analysis, and can repeat the same processes (Agar 1980).

The empirical data were analyzed following the principles of grounded theory. I also used spreadsheets to analyze the numerical data that I collected from different HCFs, mainly to compare the data collected in different months (see table 7.1, table 7.2, figure 7.2 and figure 7.3 in chapter 7, and Appendix C.4). My data were primarily 'words' supplemented with some recorded figures and photos, which I organized in the field notes. Grounded theory principles are very useful for coding and classifying non-numerical data. The method is suitable for analysis of verbal, visual, or written materials. The analysis is through systematic reduction, abstraction, and simplification of the recorded information. Categories are then set off to develop inferences and descriptions (Denzin and Lincoln 1994). Through the process of analyzing my empirical material, I organized my data in the following main themes: data collection and storage, data analysis, reporting and information flow, feedback and supervision, and information use. For the audio-recorded data, I used a simple method of listening, pausing and writing. I usually confirmed my writing by repeating the same process.

Findings were presented to the Ministry of Health at the stakeholders' workshop on December 4, 2004. This formed a basis for introducing the DHIS software. However, before this presentation, I informally presented the findings in several meetings I attended. I could also describe my preliminary findings to the health staff during the time of my field visits. For example, I could tell them "according to what I saw, data from certain programme are not recorded well, what is the problem?"

4.5 Validity and Reliability

Validity refers to the "extent to which an account accurately represents the social phenomena to which it refers" (Hammersley, 1990:57 cited in Silverman 2000:175).

"Reliability refers to the degree of consistency with which instances are assigned to the same category by different observers or by the same observer on different occasions" (Hammersley 1990:67 cited in Silverman 2000:175).

The main aim of this research was to assess the current HIS thereby exploring the procedures and tools used to collect and store routine data, identifying problems related to the current HIS and to inform the 'prototyping' of DHIS software for its adaptation to Zanzibar's healthcare system and context, as an alternative solution to the existing paper system. This study presented what was found in the natural settings, that is, at the HCFs and other health offices, interviewing the people who work in the healthcare sector, observing how the data are collected and processed, and also analysing the health data that have been recorded in past. The use of qualitative research methods emphasises the study of the natural settings of the social phenomena studied. The use of the multi-method approach also gives an opportunity to compare data from different methods. However, my knowledge of medical terms and settings was low, something that could lead to misunderstanding or misinterpretation of some concepts. The participatory action research approach was very valuable on minimizing the consequences of this, thereby emphasising mutual learning between the participants. This study can therefore, be considered to be valid and reliable to a high degree, and the findings on this research can form the basis for generalization.

4.6 Ethics

In this study, all necessary efforts were taken to ensure that ethical standards were met. This includes ethical clearance by requesting and obtaining research permits from the Chief Government's Statistician and from the Zanzibar Medical Research Board. I also obtained letters of introduction from the Ministry's headquarters and the Ministry head office in Pemba (see appendix A). During my fieldwork and in my writings I considered the following:

- Participation was voluntary and there were no threats to job security for those who declined participation.
- Informed verbal permission from all of the participants for all research activities was ensured.
- Names of participating staff are not mentioned anywhere in my presentations and writings. Furthermore I do not use the titles of staff or names of HCFs in my quotations, since the number of staff of each cadre in each HCF is very small. Naming the post or the HCF can facilitate too easily tracking a particular person who gave information, and hence may create a threat to the person's job security. Instead, I categorize staff into either health service providers or health officers, except for special instances that proved to be very secure.
- Photographs taken of the patients and clients were taken prior to their permissions, except for large groups.

4.7 Study limits

Time limitation was the main constraint to my research. My plan was to start the fieldwork in early July 2004, but I could not begin due to a misunderstanding at the Ministry regarding the permission I was previously granted. I was told that in addition to the formal permission I was granted by the Chief Government's Statistician, I was also required to apply to the Zanzibar Medical Research Board, which gave me the permission in late July, when I began the fieldwork. My research plan was seriously affected by the Ministry's plans. For example, I was not able to begin implementing the DHIS software before the Ministry was ready in December 2004.

Some key people could not be contacted because they were too much occupied with other duties. For example I never met the Micheweni DMO in my visits from August to November 2004. I could only meet the newly appointed DMO in late December. Transport also led me to select PHCs that I could easily access.

5
North 'A' District case study

In this chapter, I present the case study from North 'A' District. The case study developed is based on the interviews with the people working at the health facilities and offices, my observations, documents analysis and analysis of secondary data. The chapter is organised as follows. In section 5.1, I present the background to the case where district profile and places studied are described. In section 5.2, I describe issues around the HIS that affect the HIS performance. Finally in section 5.3, I present the description of the situation analysis of HIS in the district. The situation analysis of HIS covers the process of data collection, analysis, reporting, information use and feedback.

5.1 Background to the case

North 'A' District is located in the northeast part of Unguja North Region. The district lies between 4°S and 6°S and between 39°E and 40° E, sharing borders with North 'B' district to the south. Indian Ocean borders the district to the East, North and West. The district occupies a total of 211 km^2 with a population of 88,618 as projected for 2004 based on the 2002 National Population and Housing Census. Of this population, 3,545 are estimated to be under one year and 17,724 are under five years. The population of women within the reproductive age (WRA) is 17,724. The average household has 4.9 members.

The district is divided into 28 administrative Shehias[3]. There are 12 HCFs in the district. Of these, one is a cottage hospital (PHCC), four are PHCU 2nd line and the rest are PHCU 1st line. The HCFs are presented in Table 5.1. Almost all HCFs are in the network of paved roads with the exception of two PHCUs located on an Island called Tumbatu. Figure 5.1 shows the map of North 'A' District showing distribution of HCFs. The district has a total of 111 staff working in the public health sector, none of whom is a medical doctor or medical assistant. Access to the tape water is at 72% of the population. Agriculture is the main source of income accounting for 44% of the workforce. The district literacy rate is 46% and that of women particularly is 41%.

Malaria is the biggest health problem in the district followed by acute respiratory infections (ARI), road accidents, anaemia and diarrhoea. Recently the district has been showing a reasonable improvement in immunization services.

[3] A Shehia is the smallest administrative division in Zanzibar. The administrator is called the Sheha and is responsible for the overall administration of the Shehia.

S/No	Name of HCF	Level
1.	Kivunge Cottage Hospital	PHCC
2.	Nungwi PHCU	PHCU 2nd line
3.	Chaani Kubwa PHCU	PHCU 2nd line
4.	Chaani Masingini PHCU	PHCU 1st line
5.	Mkokotoni PHCU	PHCU 1st line
6.	Kidoti PHCU	PHCU 1st line
7.	Tumbatu Gomani PHCU	PHCU 2nd line
8.	Tumbatu Jongowe PHCU	PHCU 1st line
9.	Pwani Mchangani PHCU	PHCU 1st line
10.	Matemwe PHCU	PHCU 2nd line
11.	Kijini PHCU	PHCU 1st line
12.	Gamba PHCU	PHCU 1st line

Table 5.1: List of HCFs in North 'A' District, Source: Fieldwork at North 'A' District, July 2004.

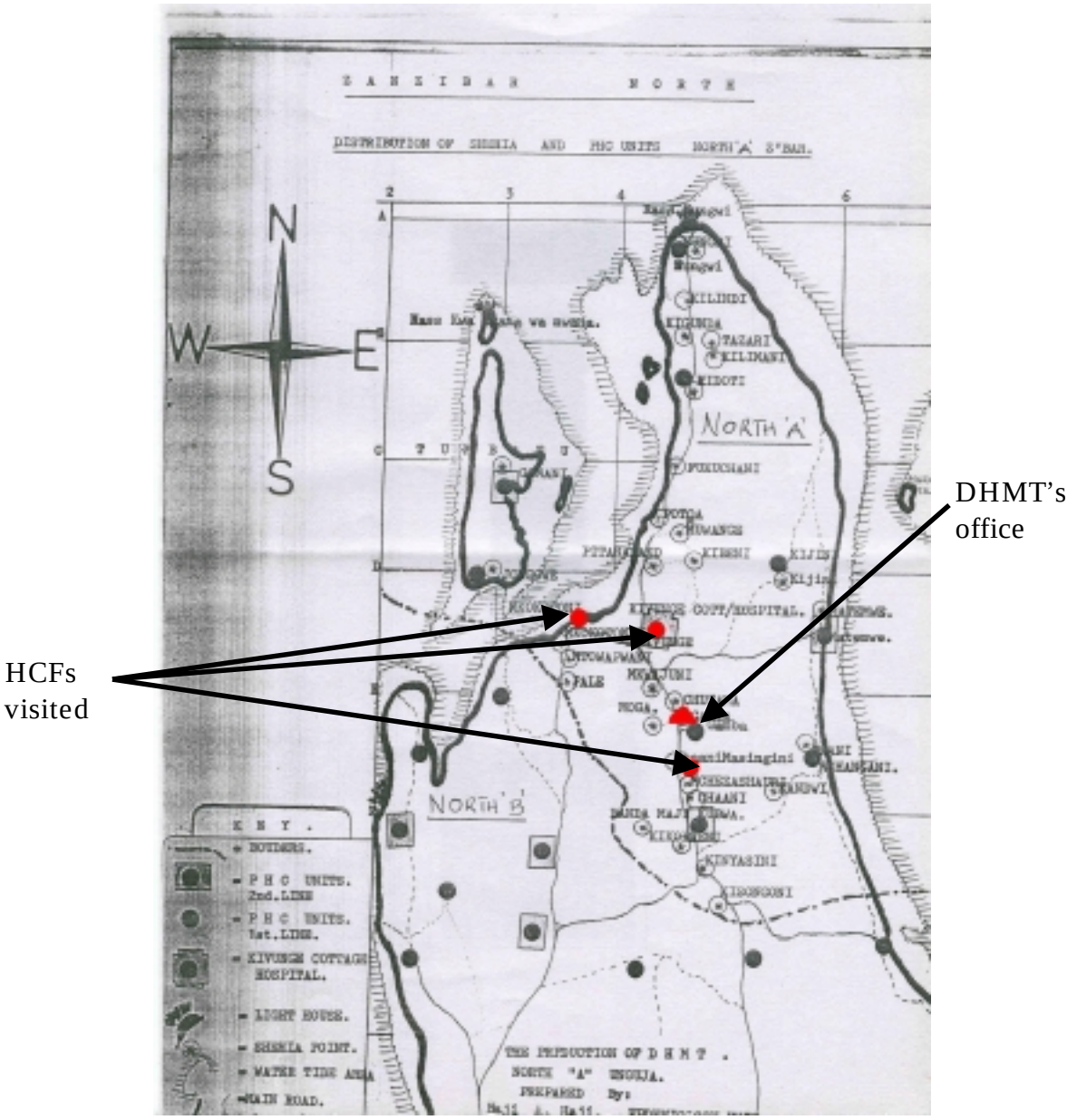


Figure 5.1: Map of North 'A' District showing distribution of Healthcare facilities. Source: Fieldwork at North 'A' DHMT office, July 2004.

5.1.1 The District Health Management Team's office

The DHMT office is located at Gamba Village, which is the district headquarters. The DHMT has an office in Gamba PHCU building where four rooms are available for their use. However, most of the time, the team meets and conducts some of their duties at Kivunge Cottage Hospital where most of them work. The DMO is also the In-charge of the hospital. In addition to the six DHMT members, there are two co-opted members helping the team, including the Matron at Kivunge Cottage Hospital and the District Planning Officer.

5.1.2 Healthcare facilities visited

In addition to the DHMT office, I visited three HCFs whose profiles are summarised in Table 5.2.

	Kivunge Cottage Hospital	Mkokotoni PHCU	Chaani Masingini PHCU
HCF level	PHCC	PHCU 1st line	PHCU 1st line
Catchment area	Six shehias of Kivunge, Mkwajuni, Pita na zako, Potoa, Kibeni and Muwange	Three shehias of Mkokotoni, Mto wa pwani and Pale	Chaani Shehia
Target population	20,402	4,056	3,419
Population under one year	717	161	137
Population under five years	4,080	811	684
Number of women in the reproductive age (WRA)	4,080	811	684
Services provided	Outpatient, inpatient, MCH, maternity, laboratory, dental and special clinics including eye, diabetic, hypertension and psychiatry.	Outpatient and MCH.	Outpatient and MCH.
Main disease treated	Malaria	Malaria	Malaria
Number and cadres of staff	67 employees including 4 clinical officers, 12 staff nurse midwives, 1 nurse officer, 1 psychiatric nurse, 2 senior nurses, 3 lab technicians, 2 pharmacy productions, 19 health orderlies[4] and 15 administrative staff.	5 employees: 1 psychiatry nurse, 1 MCH Aide, 1 health officer and 2 health orderlies.	4 employees: 1 community health nurse, 1 MCH Aide and 2 health orderlies.
State of building	Good.	Very poor, but there are plans to construct a new building.	Fairly good.

Table 5.2: Profile of the HCFs visited. Source: Field visit North 'A' District July – December 2004.

[4] Health orderlies are non-professional staff trained at the HCF to assist professional staff.

Kivunge Cottage Hospital.

Mkokotoni PHCU.

Photo 5.1: Kivunge Cottage Hospital and Mkokotoni PHCU are among the HCFs visited (Photographer: Author, July 2004).

5.2 Issues around the HIS

Several issues, including human resources, logistics, transport and communication, and financial resources, largely affect the functioning of the HIS. These issues are now briefly discussed.

5.2.1 Human resources

The problem of human resources can be explained in terms of the lack of adequate qualified staff. Almost all the HCFs reported the same problem. Both Mkokotoni and Chaani Masingini PHCUs has only one qualified staff at each clinic, that is, one MCH Aide working at the MCH clinic and one Prescriber[5] working at the outpatient department. This problem is magnified when one of the staff takes leave. I visited Chaani Masingini PHCU twice, and on the first day I met only the Prescriber while the MCH Aide was absent. When I visited the HCF again, the MCH Aide was present but was a new one, while the Prescriber was absent, attending a meeting. The MCH Aide thus had to serve the MCH clinic assisted by a health orderly, and at the outpatient department.

At the MCH clinic of Kivunge Cottage Hospital, there are three nurses and one health orderly working. However this is a big centre and hence they serve more clients and sometimes they go to help the maternity ward. The same staff participate in the outreach programmes organised by DHMT. As a result, there is too high workload imposed on them. One MCH Aide claimed:

> *There is high workload here and I need to go out for vacation, but is not easy to get a leave.*
>
> *(Health service provider, North 'A' District, July 2004)*

[5] A health staff prescribing patients at the outpatient department (OPD)

At the maternity ward, the nurse responded.

> *Sometimes it is very busy here. I can just record the patient's information to a piece of paper, especially when the patographies[6] are not present and later record to the delivery register.*
>
> *(Health service provider, North 'A' District, July 2004)*

At Mkokotoni PHCU, I did not meet the MCH Aide on the first day since she was resting that day. This HCF has been ordered by the Ministry to operate seven days a week. Hence the MCH Aide had to exchange shifts with the Prescriber. When the MCH Aide rests the MCH clinic usually does not provide vaccination services. However this is not possible for the outpatient services; therefore, when the Prescriber is absent, the MCH Aide has to work for both sections assisted by the health officer and health orderly.

Photo 5.2: MCH clients at Kivunge Cottage Hospital waiting for the services. The queue continues along the next side (Photographer: Author, July 2004).

Another problem experienced by both HCFs is the presence of many unqualified staff (see Table 5.2 for the number and cadres of staff). This has a direct impact on the way that data are collected and handled. The professional staff that attended at least a basic course on data handling as part of their professional course will be very different from the staff that are trained at the HCF. At Mkoktoni PHCU, I observed very inconsistent data in the Family Planning book, some of the vials were exchanged and surprisingly for one client it was recorded that she took six injections. When asked about this, the MCH Aide replied that it was the health orderly that recorded it and she further added:

[6] Record of labour form

> *I usually train my assistant here very well. You know I have enough experience [22 years on the same post], but the problem is that they frequently change them once they get fine so I do not benefit from them. I have claimed this to [the] DHMT several times and they promised that the previous one could not go but she has gone!*
>
> *(Health services provider North 'A' District, August 2004)*

At the DHMT, all members are professionals with respect to their respective posts with the exception of Financial Manager who is by training a public health officer and has never attended any course on finance. All staff here are fully dedicated to their posts except the DMO who is also the In-charge of Kivunge Cottage Hospital. The DMO claims that she is always busy working as the DMO, attending patients and also doing hospital administrative work. She usually checks all the district data they receive in her extra time.

> *I am busy and I have to check all these [pointing to the forms]. I work with the data in the evening at my house.*
>
> *(DMO North 'A' District, July 2004)*

5.2.2 Material resources

There are other issues affecting the HIS performance both at the HCF and the district levels. The physical conditions of some of the HCFs and the file storage system, as well as the availability of some services like photocopy services are problematic. Staff usually photocopy at a private centre where A4 paper costs TSHS 50 (USD 0.05) per page and A3 costs TSHS 80 (USD 0.08). The DHMT usually photocopies the periodic reports that they produce, and sometimes the data collection forms at their own costs.

At Kivunge Cottage Hospital, staff claimed that they do not have a computer for the hospital. Instead they use the DHMT's computer, a new Pentium IV Dell PC with 80 GB HDD and 256 MB RAM donated by NORAD and WHO. At the time I visited on July, there was no printer but when I visited again in September, an HP LaserJet 2200 had been installed. This computer is mainly used for secretarial purposes.

The paper file storage is very poor except at Kivunge Cottage Hospital and the DHMT office where medium-sized file cabinets are used to store files. These seem to be sufficient for the time being, but later can prove to be insufficient. Also there were some complaints on the ability of staff to properly manage data files. At Chaani Masingini PHCU, the files are stored in a box at the outpatient department and some are stored on a table at the MCH clinic. Some boxes used to store files are located at the house of the PHCU In-charge. However, there is a file cabinet at the HCF but it is kept in a storeroom and is not currently used. Some time ago, it was also used to store medicines. The files used to keep forms and reports, have been bought by staff themselves on their own initiatives. The HCF In-charge explained:

> *I love my job and my office. I need a tidy office…You see we have not received uniforms for two years.*
>
> *(Health service provider, North 'A' District, August 2004)*

At Mkokotoni PHCU, the files are stored in a drawer. The old patient registers are stored on a table in the dressing room, which is also used as a waiting room during the rainy season. Generally the PHCU is in poor condition and in need of rehabilitation. Staff claimed a shortage of space and poor condition of the PHC to be one reason for not displaying reports. The condition is worse when it rains and all the rooms and walls get wet.

> *We see the importance of graphs but we are not preparing [them because] we do not have resources, even paper. Time is available and we are technically able to prepare some. Usually we serve patients up to 14:00 only…We also do not have [a proper] place to keep them. [Both storage and display board are in a very poor condition]…you see all file cabinets are full and some files are under the bed [pointing to the bed]*
>
> *(Health service provider, North 'A' District, August 2004)*

At the MCH clinic of Mkokotoni PHCU, the filled forms are stored in a file cabinet. But the system is very jumbled and when I asked if I can get the tick sheets for the previous months, I could only get very few of them. The rest were somewhere else not known.

5.2.3 Transport and Communication

Distribution of supplies including forms is usually done by DHMT. In this way, transport is an important issue at the district level more than for the individual HCFs. However there is a need for effective communication systems between the HCFs and the DHMT.

Of all 12 HCFs in the district, only Kivunge Cottage Hospital has transport. The DHMT itself does not have a car special for their work. At KCH there are two cars, one ambulance and one other car. The ambulance was donated by the United Nations Population Fund (UNFPA), intended to serve the maternity ward only. Subsequently the hospital administration decided to use the ambulance for all hospital referral cases. Patients' relatives or the staff usually donate fuel for the ambulance. The second car is usually used for the hospital administration. The DHMT uses the same car to distribute medical and other supplies, distribute and collect forms, conduct supervision, and to provide outreach programs and public health education services. Only Safe Motherhood Programme and EPI contribute fuel for the car, totalling up to only 20 litres a month, which is insufficient to cover all programmes, thus forcing the office to seek funds from somewhere else. Currently the DHMT does not get any funds from the Ministry, although at the time of writing DANIDA was expected to provide support shortly. Currently, staff contribute some money from their own pockets when they get something extra from their salaries. A health officer explained:

> *When you go out for the seminar, you must return a certain amount of money you get there to help for our programmes… We all agreed on this.*
>
> *(Health officer North 'A' District, July 2004)*

Of 12 HCFs in the district, ten are in a network of paved roads and hence are easy to access. Two of the HCFs are located in Tumbatu Island and the staff of the HCFs usually come to collect forms and bring back the reports when they come to collect medical supplies and salaries. The island can be reached by either public boat that requires one to come back the next day, or by hiring a boat at TSHS 30,000/- (USD 30). There are five outreach sites in the district where four of them cannot be easily accessed due to poor road conditions. However the DHMT usually helps with transportation for the responsible staff from nearby clinics. This car therefore is insufficient to cover all programmes, especially when considering the small amount of fuel supplied.

The telephone is a very important tool for communication between the HCFs and the DHMT because of the lack of transport and the high cost of public transport. However, only two mobile phones were donated by NORAD and WHO to Kivunge Cottage Hospital. The donors are also responsible for recharging the mobiles. But the need is higher in the other HCFs that are distant from the DHMT office. Therefore, the donated phones can be used to communicate to the higher levels and between DHMT members or when they need to know something from HCFs. In all of the HCFs I visited, staff have their personal mobile phones and are responsible for recharging them even when they use them for the clinic work. A staff in one HCF stated that the Ministry should help them to recharge their mobiles.

> *We have bought the telephones from our own pockets, but at least if the Ministry could help to recharge because we most of the time use them for clinic works.*
>
> *(Health service provider, North 'A' District, August 2004)*

A staff at another HCF complained.

> *We have no telephone here. I can only communicate with DHMT using my personal mobile phone. If I do not have credit then I will have to take daladala[7]… but it is 100 Tanzanian shillings only [USD 0.1].*
>
> *(Health service provider, North 'A' District, August 2004)*

5.2.4 Financial resources

The availability of adequate financial resources can largely solve the issues discussed above, that are shaping the working environment of the HIS. However, the problem of financial resources was reported at all of the HCFs that I visited and also at the DHMT office. Almost all photocopy services ere paid from the staff's own pockets. At Kivunge Cottage Hospital, the problem of poor financial support is reported to be

[7] Public transport

ongoing for three years, and the hospital was not even able to provide food for the inpatients for about five months up to my first visit on July 2004. The DHMT, which in turn could support the HCFs, does not receive any funds from the Ministry, which seriously impedes their activities. For example, the two HCFs located in Tumbatu Island were rarely supervised due to the lack of finances to hire a boat for that purpose. Various staff had the same opinion about poor financial resources.

> *DHMT has been facilitated only in words…imagine in case of a problem [at the district] we have to go to request [some money from MOH] and sometimes get nothing.*
>
> *(Health officer North 'A' District, August 2004)*

> *The district is not self-reliable, the decentralization is just being mentioned but it has not yet started…Decentralization needs resources including money. We receive nothing.*
>
> *(Health service provider, North 'A' District, August 2004)*

> *There is no finance programme to HCF or proper supply of resources. Staff usually buy stationeries themselves.*
>
> *(Health service provider, North 'A' District, August 2004)*

However, some donors have shown an interest to help the district. These include NORAD and WHO, European Union (EU) which will support training to the DHMT and HCF staff, and DANIDA which is the main sponsor of the Ministry of Health.

5.3 Situation analysis of HIS

In this section, I describe the situation analysis of HIS in the district, as reported from the HCFs and the DHMT. The situation analysis covers the information process through data collection, analysis, reporting, information use at the HCFs and the DHMT and the feedback system.

5.3.1 Data collection

Health workers primarily collect primary healthcare routine data at the HCFs. The data collected are for outpatients, consumption of medicines, and from the MCH clinic including EPI, antenatal care (ANC), children attendances, nutritional assessments, immunizeable diseases surveillance and family planning. TBAs also contribute to the primary healthcare data collected. However, there is no proper recording system for this since they neither report to the HCF nor to the Shehas, where they are supposed to report any deliveries or deaths. Instead only delivery data are recorded, based on mothers attending MCH clinics. Mothers are required to state whether they delivered in hospital, by MCH Aide or by TBA. The MCH Aides stated that they usually record these data into unformatted exercise books prepared locally, but I never saw these books. The other source for the data is the maternity ward where data on hospital deliveries are collected.

Tools used to collect data

At the HCF level, different forms and registers are used as the primary data collection tools. While the supplier already formats some of the registers and forms, others are locally prepared at the HCFs using normal exercise books. All tools are supplied by the DHMT on the first Monday of each month when distributing MCH supplies. However, the reliability of the supply depends on the programme requesting the data and who has designed the forms. At all the HCFs I visited, Stroke-forms[8] and data collection forms at the MCH clinics were usually available. However, MCH clinics receive every form in a pair of two copies every month. This can be a problem in case one or both copies are destroyed or lost. In this case, or in other shortage case, the staff at the HCFs may prepare the form by hand. An MCH Aide in one clinic explained

> *In case of shortage we use common sense, we prepare a form like this [showing an original tick sheet] and then we do the job [of recording].*
>
> *(Health service provider, North 'A' District, August 2004)*

The Family Planning Programme however, uses MTUHA[9] forms and registers causing misunderstanding since the Tanzania Mainland context where the forms come from is a bit different to the Zanzibar context. For example, different contraceptives are used and also personal data of clients from the two contexts do not match. Ledgers are also steadily supplied. Table 5.3 shows the basic PHC data collection tools used at the HCF level for different programmes.

Form/Register	Category and purpose	Formatted by the supplier	Supplied by	Availability
Immunization register	EPI – used to register new babies who live in the catchment area taking vaccines	Yes, but sometimes extra fields may be added locally	DHMT from EPI	Reported to be always available
ANC register	EPI – used to register pregnant mothers who are living in the catchment area attending ANC clinic	No, locally prepared using exercise books	DHMT	Reported to be always available
Fomu ya muoanisho wa chanjo na Vitamin A	EPI – a tick sheet used to record all children and	Yes and in good layout	DHMT from EPI	Most of the time, if not available a locally

[8] Stroke-forms are tally sheets used to record the number of outpatient cases categorised by age and sex.
[9] The HIS that is used by the Ministry of Health of Tanzania Mainland

(Vaccination and Vitamin A supplementation form)	mothers who took vaccines or Vitamin A supplement			prepared one is used
Family planning register	FP – used to register family planning clients. This is MTUHA book	Yes, but fields do not reflect local needs	DHMT from FP	Most of the time
Day-to-day book	FP – used to record all services given to FP clients. This also comes from MTUHA	Yes, but fields do not reflect local needs	DHMT from FP	Reported to be always available
FP ledger	FP – used to record contraceptives' stock at the clinic.	Normal ledger	DHMT from FP	Most of the time
Patients' register	OPD – used to record all outpatients cases and whether if new case or re-attendance	Yes (2/3) HCFs visited, No (1/3) HCFs visited	DHMT	Always available, at least unformatted exercise books may be available
Stroke-forms	OPD – used to record (tick) all outpatients visiting HCF categorized by diseases, age and sex	Yes	DHMT. DHMT receives from the Statistics Unit of the Ministry of Health	Reported to be always available
Daily Dispensing Register	OPD – a ledger used to register all medicines used at OPD	Yes (1/3), No (2/3)	DHMT. DHMT receives from Medical Stores Department (MSD)	Reported to be always available
Ledger	OPD – used to record the	Normal ledger	Medical Store	Still new to the HCFs. Came

	stock of medicines at the HCF		Department (MSD)	when the medicines start to be distributed.

Table 5.3: Basic PHC data collection tools. Source: Fieldwork North 'A' District, July – December 2004.

There is no recording system for the public health education programme, and neither is there a standard information system for laboratory activities. At Kivunge Cottage Hospital, the only laboratory tests recorded are for Malaria and VCT/HIV where their respective sponsors, Malaria under the Malaria Programme and VCT/HIV under Medicos Del Mundo supply the recording tools.

Data storage

The forms, summary books and registers are stored at different places from different HCFs and in most cases in a poor environment. At the MCH section of Kivunge Cottage Hospital, the forms are stored in files, which are kept on the table that is used for vaccination and other activities in the clinic. Other files are stored in the file cabinets at the Matron's office and in the office of the In-charge of the hospital. At Mkokotoni PHCU, files are stored in a drawer and the old patient registers are stored on a table in the dressing room. The same room is used as a waiting room during the rainy season. Other files are kept under the bed in the prescription room.

Photo 5.3: File storage for the past data at Mkokotoni PHCU. (Photographer: Author, August 2004)

At Chaani Masingini PHCU, there is a file cabinet that was used to store medicines and forms, but currently it is kept in a storeroom and is no longer used. The files used to keep forms and reports, were often purchased by staff themselves. Boxes are used to store the files and registers in the prescription room and some of them are stored in the house of the HCF In-charge. Files at the DHMT office at Gamba are stored in a medium-sized file cabinet, which seems to be enough for now but can prove to be insufficient subsequently in the future.

5.3.2 Analysis of data

In this subsection, I describe the process of data analysis at both the HCF and the district level.

At the HCF level

At the HCF level, little analysis of collected data is done. For the OPD section, the Stroke-forms are usually sent to the DHMT without being touched. However, the HCFs usually record the same data mapping the Stroke-forms into small exercise books bought by the HCFs themselves since this is not directed by the DHMT. Data from this book can be used locally to prepare a monthly summary that can also be used to create some graphs and charts. The book is also used as a backup to the data sent to DHMT, as one health service provider explained.

> *In case DHMT lost a Stroke-form then they can come back to the HCF to check for the information in the prepared reports.*
>
> *(Health service provider, North 'A' District, August 2004)*

The HCFs also prepares annual report based on the monthly summary. There is also a monthly report for the consumption of medicines prepared in the form of a ledger to show the status of supplied medicines stock. However, of the three HCFs visited, only one uses a real ledger book to prepare these reports and the remaining two use normal exercise book formatted locally. At the MCH clinics, there are different monthly reports produced. The reports are made from the summaries of daily records. The monthly reports produced are described in Table 5.4 (for examples see Appendix C).

Report (monthly)	**Uses**	**Formatted when supplied to the HCFs**
Vaccination and Vitamin A report – a monthly summary of vaccination and Vitamin A supplementation to children, pregnant women and women in the reproductive age.	Sent to DHMT with a copy remaining at the HCF.	Yes, most of the time.
Taarifa za utendaji (vaccination assessment report) – a report and graphs showing the trends of vaccination to children and mothers in the cumulative of months. The graphs also show if the trend is in good position. Different graphs are in different colours.	Displayed at MCH clinics of the HCFs.	Yes but limited to only three vaccination for each graph, while it may be needed to have more than three as in the case of Polio 0 to 3.
Monthly surveillance report for immunizeable diseases showing the number of immunizeable diseases	Sent to DHMT	Yes.

cases reported together with the particulars of each patient		
MCH report (there is no specific name or ID) – a monthly summary of children and mothers visits	Sent to DHMT with a copy remaining at the HCF.	Yes, most of the time.
Family planning report (there is no specific name or ID) – a monthly summary showing number of clients to FP services and the trends of the contraceptives use.	Sent to DHMT	Yes but very poor.
Report and Request for Contraceptives – a subset of the family planning report formatted specifically to show contraceptives stock. The report comes from the National Family Planning Programme based in Dar es salaam, and is the one used by the Ministry of Health Tanzania Mainland.	Sent to DHMT	Yes.

Table 5.4: List of monthly reports prepared at MCH clinics. Source: Fieldwork North 'A' District, July – December 2004.

At the district level

At the district level, data from different HCFs are usually summarised to form district reports for the different programmes. A pair of people at the DHMT office, one for counting and then recording, and the other for summing by using a calculator usually conducts the compilation process. Before the summarisation process starts, the DHMT staff usually check the forms for completeness and accuracy, as one officer responded,

> *We usually check the forms we collect. When we are in doubt with some forms we then go to check the original data at the HCF… For example if a facility reports high figures on malaria, or for example if a facility reports much on a disease which is not usually there. Also when we go out for supervision we check the registers and direct them [on how to properly record data]. We also observe the use of guidelines.*
>
> *(Health officer North 'A' District, August 2004)*

Several periodic graphs and charts (see Photo 5.4) are also produced including the district immunisation coverage, the top ten diseases in the district and trends of specific diseases in the district. Another DHMT member emphasised,

> *[Yes] we do [analysis]. For example for malaria we know where it is high and to which extent. We also know about deaths where there is high frequency and hence find which disease is a major cause and we discuss how to improve.*
>
> *(Health officer North 'A' District, August 2004)*

The quality of the graphs and charts produced is reasonable. One officer explained that they had eight weeks of training (including two weeks of fieldwork) that helped them in making a more realistic analysis of data. She further added,

> *We used to have all data on walls but [after that training] we realized that graphs and charts are better. We took them off [and display the graphs and charts] and you see now…we need more training on computers and working with data.*
>
> *(Health officer North 'A' District, August 2004)*

Photo 5.4: Several graphs and charts prepared and displayed at the DHMT office. (Photographer: Author August 2004)

5.3.3 Reporting and information flow

Two reporting procedures exist. The monthly reporting from the HCFs to the DHMT and from DHMT to the higher levels, and the quarterly and annual reporting from the DHMT to the higher levels. Figure 5.2 shows the data flow process from the local level to the national level.

Usually the DHMT collects the monthly reports from the HCFs on the first Monday of each month when the DHMT distributes MCH supplies. However, the two HCFs located on Tumbatu Island do not benefit from this, and instead they usually send the reports themselves, but the DHMT acknowledged that they always report on time. The monthly reports that the DHMT collects from the HCFs are shown in table 5.3, in addition to the Stroke-forms that are usually sent to the DHMT unprocessed.

The DHMT is basically preparing only three monthly district reports: EPI, FP and MCH. The compiled district reports are usually sent to their programme offices each month but not to the Zonal office. The district EPI report is usually sent together with the individual HCF report. Usually there are no specific forms for the district reports

and instead the same HCF form is used. The individual Stroke-forms from each HCF are usually sent to the Ministry's Statistics Unit at Mnazi Mmoja. In addition to these, the district produces quarterly and annual reports that are sent to the Zonal office and the Ministry of Health headquarters. The reports show the district health profile for the specified period.

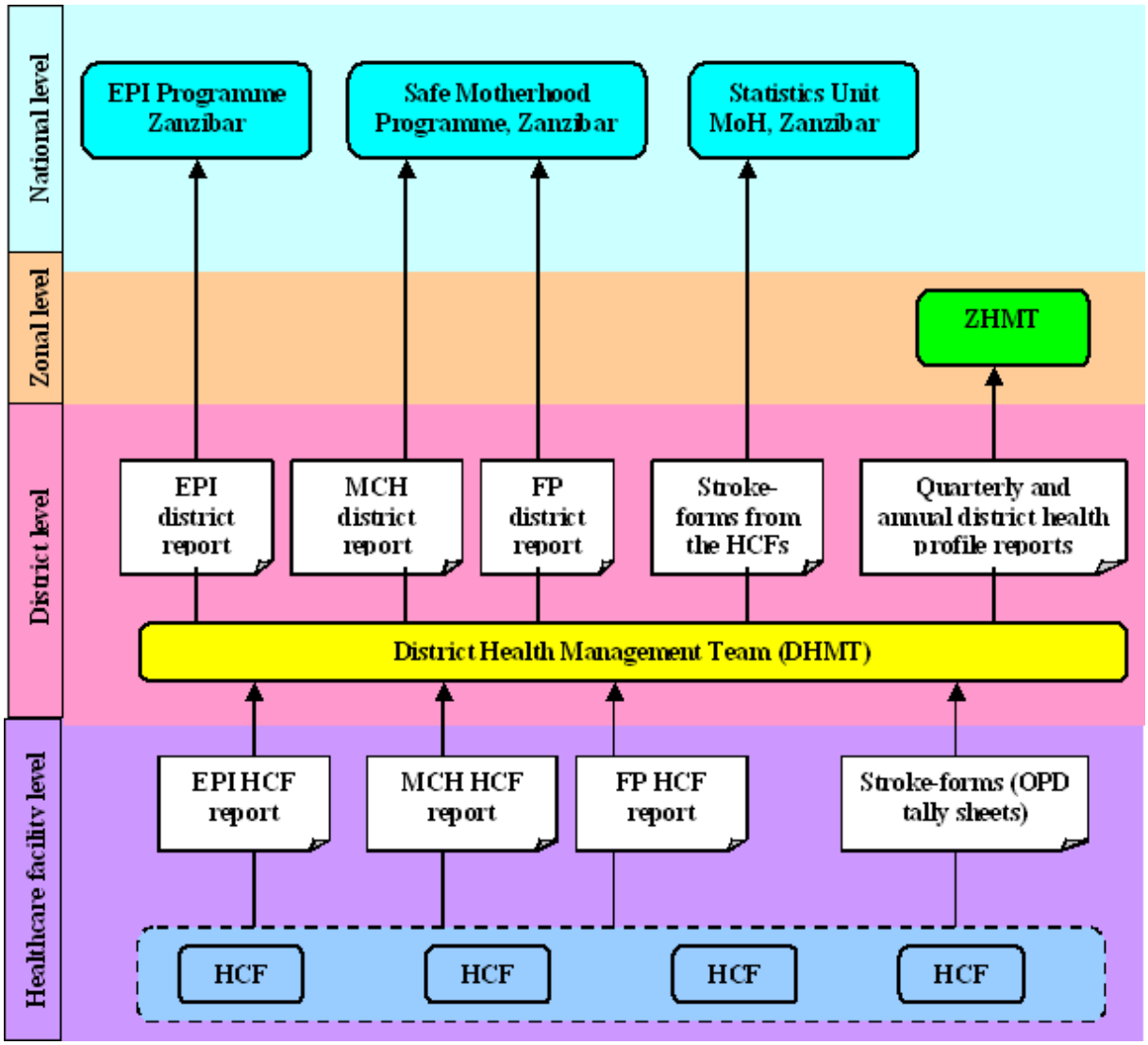


Figure 5.2: Data flow from the local level to the national level. Source: Fieldwork North 'A' District, July – December 2004.

5.3.4 Feedback and supervision

In this subsection, I explain the process of the feedback and supervision identified in the case study. The discussion is organized into three parts: from the higher levels to the DHMT, from the DHMT to the HCFs and from the HCFs to the community.

To the DHMT

Generally there is no working feedback procedure from the Ministry's headquarters to the DHMT and there is limited supervision. The Ministry used to conduct quarterly meetings, which was the main method for feedback, but due to lack of

adequate funds, this practice was discontinued for one year to the time of the fieldwork except in an emergency. The same is also the case with the ZHMT, which could only ask if the quarterly reports are not sent on time. One DHMT member insisted.

> *But now there is no feedback. They just want reports, and they want them on time.*
> *(Health officer North 'A' District, July 2004)*

From the DHMT to HCFs

Usually there is a supervision programme for DHMT to HCFs. Every month a number of HCFs are supervised and the schedule for this supervision is displayed at the DHMT office and also at the office of the In-charge of Kivunge Cottage Hospital who is the DMO. In case any HCF has problem with data, they come back with the forms to the HCF, or if it is a general problem they conduct a meeting at the DHMT office to explain the problem.

From the HCFs to the community

Two procedures are used by the HCFs to give feedback to the community. First, by providing public health education to the clinic attendants every morning where in addition to the general public health education, specific problems identified are given special emphasis. Also during the service provision, individual health education can be given to the client when seen as important. The second procedure is by organising meetings with the Shehas to explain about the problems identified in the community. At Chaani Masingini the HCF In-charge emphasised.

> *We usually give feedback to the community. At present I have organised a meeting with health committee of the shehia about neonatal tetanus, also about measles. There are people who do not bring their babies for vaccinations and they tick their cards. Also we will be talking about AFP [acute flaccid paralysis]. These are my agendas…We also need to promote the skills of the TBAs in order to avoid these problems.*
> *(Health service provider, North 'A' District, August 2004)*

5.3.5 Information use

Both HCFs and the DHMT showed some efforts on the local use of information. However, the level of use differs from HCF to HCF depending on the level of the HCF and the capability of the staff at the HCFs.

At HCF level

The information use for local managerial decision-making at almost all the HCFs visited is limited. At the OPD, only one HCF (Chaani Masingini PHCU) explained that they use the data recorded into a small exercise book to monitor trends of diseases in order to take appropriate actions such as public health education provision. However, I did not get evidence of this, as there were no graphs or reports prepared and presented. Information use also depends on the person responsible. At

Chaani Masingini PHCU for example, the HCF In-charge insisted on the data use and even more the use of maps. He explained.

> *Maps are important. You know you need to know your catchment area and the sources of problem. These maps can be used to identify sources of problems as they can show the location of houses, watersheds and bushes.*
>
> *(Health service provider, North 'A' District, August 2004)*

At Mkokotoni PHCU, I observed a map (Figure 5.3) that was used during a diarrhoea outbreak at Mkokotoni in 2004. In this map the houses where the patients came from were indicated, making it possible to project how likely the disease can spread. In all the HCFs, the patients' prescription books are a useful source of information when a Prescriber needs to decide whether the case he/she attends is considered a new one or of re-attendance. The date of the last visit for that case is the one used for making this decision.

Figure 5.3: A map used during 2004 diarrhoea outbreak at Mkokotoni village. Source: Fieldwork, North 'A' District July – December 2004.

At the MCH clinics the situation is a bit better. Cards, especially babies' vaccination cards, are very useful for local information use. The MCH Aide always looks at the trend of a child's growth on the card, and if not satisfactory she gives individual health education to the affected person. At Kivunge Cottage Hospital, the MCH Aides claimed that they use the vaccination trends reports they prepare to evaluate the services they provide, that is, if they are within the required range from the targets. In case of problems, the staff have to identify possible sources and solutions.

We prepare the annual reports… When a guest comes, like you, we show him. We also use the report to evaluate our services provision. How effective we are. We look at possible sources of problems and we propose solutions.

(Health service provider, North 'A' District, August 2004)

At the district level

The information generated is mainly used to determine whether the services provided are enough, and also to check the prevailing diseases and places where they have high rates. The DHMT also uses the information to seek help from the National/Zone when some diseases spread excessively and they are not able to take care of it.

You see some data here [pointing to data in a report kept on the wall] on Tetanus Toxoid dropped especially in this area [Kivunge, Gamba and Chaani], we had meeting with Shehas and we made a plan and identified tasks to be done.

(Health officer North 'A' District, July 2004)

Explaining about how useful the graphs they have presented are, the DMO responded.

These graphs are very useful, for example for the malaria cases it is clearly shown in the graphs that the peak points are in June and July. These are the periods after heavy rains where there are more mosquitoes born. Using this information the office and HCFs get prepared for receiving more malaria patients and also for mobilization.

(DMO North 'A' District, July 2004)

First, if a guest comes it is easy to know without asking questions, and to us [staff] it gives an easy way to measure our performance rather than going to check the original files. These maps also help to know where our facilities are and how many of them. You see here [pointing to a small island on a map] it is easy to explain to a guest that we have two facilities in this island, you see.

(DMO North 'A' District, July 2004)

6
Micheweni District case study

In this chapter, I present the case study from Micheweni District. The case study developed is based on the interviews with the people working at the health facilities and offices, my observations, documents analysis and analysis of secondary data. The chapter is organised as follows. In section 6.1, I present the background to the case where district profile and places studied are described. In section 6.2, I describe issues around the HIS that affect the HIS performance. Finally in section 6.3, I present the description of the situation analysis of HIS in the district. The situation analysis of HIS covers the process of data collection, analysis, reporting, information use and feedback.

6.1 Background to the case

Micheweni District is situated in the northern part of Pemba North Region. The district shares borders with Wete District to the South and the Indian Ocean to the East, North and West. The district occupies a total of 260 km^2 with a population of 83,266 as projected for 2004 based on the 2002 National Population and Housing Census. Of this population, 3,430 are estimated to be under one year and 17,447 are under five years. The population of women within the reproductive age (WRA) is 17,447. The average household has 5.4 members.

The district is divided into 14 administrative Shehias. There are 13 HCFs in the district. Of these, one is a Cottage hospital (PHCC), two are PHCU 2nd line and the rest are PHCU 1st line. The HCFs are presented in Table 6.1. Only four HCFs are in the network of paved roads, but for the remaining HCFs the roads are also passable. Figure 6.1 shows the map of Micheweni District showing the distribution of HCFs. The public health sector in the district employs 79 staff. Of these, only three are medical assistants and are all working at Micheweni Cottage Hospital. The district has 78.57% of the population who have access to piped water. However, only 14% of all houses have latrines, which makes the population more vulnerable to diseases like diarrhoea, intestinal worms and anaemia. Agriculture is the main source of income.

Malaria is the biggest problem followed by pneumonia, diarrhoea, bronchitis, intestinal worms and anaemia. The district is among the poor performers of the immunization programme in Zanzibar. Several measles cases are reported from almost all the HCFs.

S/No	Name of HCF	Level
1.	Micheweni Cottage Hospital	PHCC
2.	Wingwi PHCU	PHCU 1st line
3.	Tumbe PHCU	PHCU 1st line
4.	Konde PHCU	PHCU 2nd line
5.	Msuka PHCU	PHCU 1st line
6.	Makangale PHCU	PHCU 2nd line
7.	Maziwa Ng'ombe PHCU	PHCU 1st line
8.	Kiuyu Mbuyuni PHCU	PHCU 1st line
9.	Shumba Vyamboni PHCU	PHCU 1st line
10.	Finya PHCU	PHCU 1st line
11.	Kinyasini PHCU	PHCU 1st line
12.	Kiuyu Kipangani PHCU	PHCU 1st line
13	Sizini PHCU	PHCU 1st line

Table 6.1: List of HCFs in Micheweni District. Source: Fieldwork September 2004.

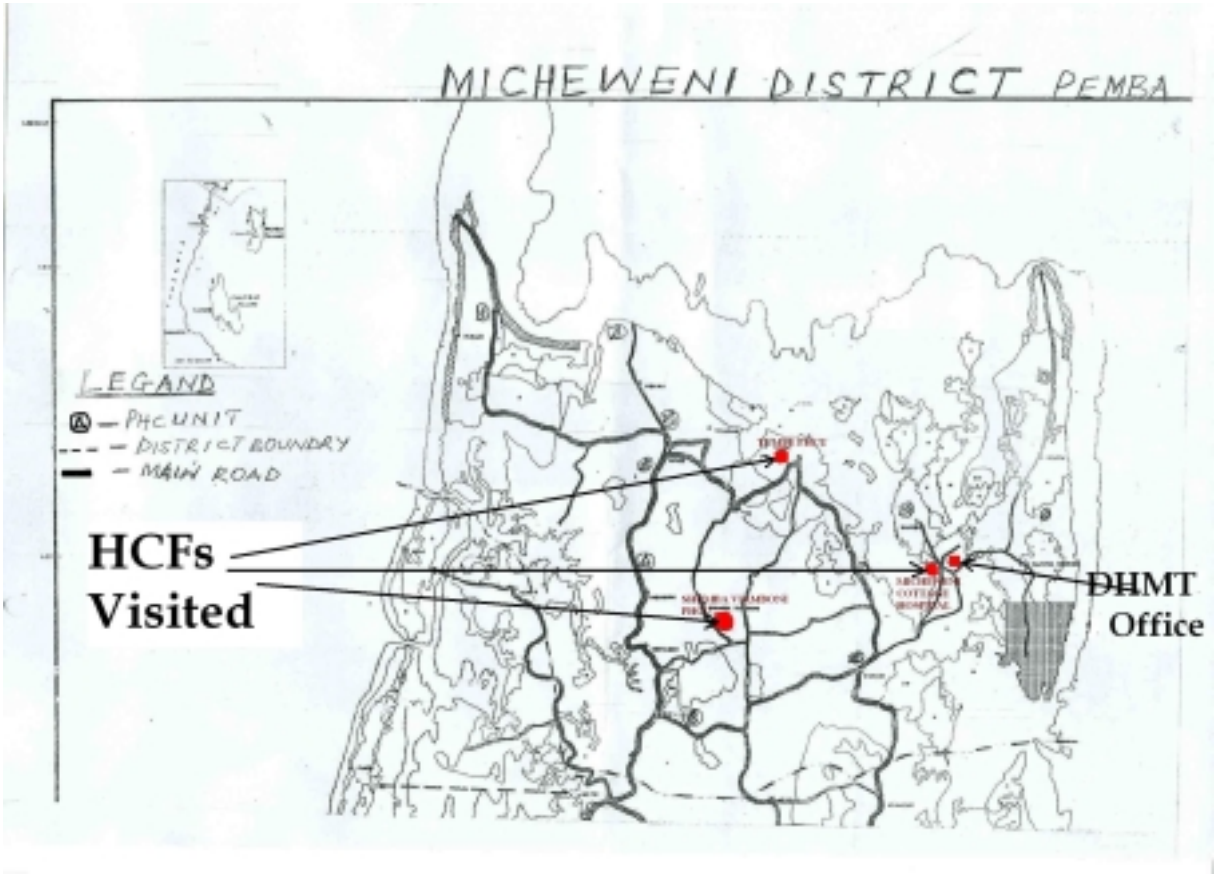


Figure 6.1: Map of Micheweni District showing distribution of HCFs. Source: Fieldwork at Micheweni DHMT office, September 2004.

6.1.1 The District Health Management Team's office

The DHMT office is located at Micheweni, the district headquarters. There is a separate building for the DHMT and there is enough space for the office. During the

period of this study, the office had no electricity but processes were on the way to install electricity in the office. In addition to the six DHMT members, there is also one co-opted member who works as a clerk in helping the team.

Photo 6.1: Micheweni DHMT office (Photographer: Author, September 2004).

6.1.2 Healthcare facilities visited

In addition to the DHMT office, I visited three HCFs whose profiles are summarised in Table 6.2 below.

	Micheweni Cottage Hospital	Tumbe PHCU	Shumba Viamboni PHCU
HCF level	PHCC	PHCU 1st line	PHCU 1st line
Catchment area	Two shehias of Micheweni and Shumba Mjini.	Tumbe shehia and Chimba village.	Shumba Viamboni shehia.
Target population	12,597	10,297	4,730
Population under one year.	504	412	189
Monthly immunization target for children	42	34	16
Population under five years.	2,519	2,059	946
Number of women in reproductive age (WRA)	2,519	2,059	946
Services provided	Outpatient, inpatient, MCH, maternity, laboratory, dental, STD / HIV and special clinics including eye,	Outpatient and MCH.	Outpatient and MCH.

	diabetic, hypertension and psychiatry.		
Main disease treated	Malaria	Malaria	Malaria
Number and cadres of staff	Could not be obtained but there are three medical assistants.	6 employees: 2 public health nurses 'B', 1 Community health nurse, one1 Rural health Aide and two2 health orderlies.	3 employees: 1 Psychiatric Nurse, 1 MCH Aide and 1 health orderly.
State of building	Fairly Good.	Fairly good	Very poor.

Table 6.2: Profile of the HCFs visited. Source: Fieldwork Micheweni District, August – December 2004.

6.2 Issues around the HIS

Several issues, including human resources, logistics, transport and communication, and financial resources, largely affect the functioning of the HIS. These issues are now briefly discussed.

6.2.1 Human resources

In Micheweni District, I observed the problem of lack of adequate staff both at the HCFs and the DHMT. The DMO of Micheweni District is also the ZMO of Pemba Zone and he also attends some surgery sessions at Wete Hospital. The DMO is professionally anaesthesiast. In all my visits to the DHMT, I never saw him and the other staff explained that he works more for the zone rather than the district, and there was no alternative person who could take his position. When I visited the DHMT in late December 2004, a new DMO had been appointed but he is also the In-charge of Micheweni Cottage Hospital. In almost all the HCFs I visited, Prescribers explained the problem of too much workload stating that sometimes they may forget to record data, as they give priority to attending patients who come in large numbers.

At the MCH clinics, the situation is worse. Only at Micheweni Cottage Hospital, I observed more than one staff working at the clinic at a time. At Tumbe PHCU, there are two staff but one was on maternity leave and the other one was working for two PHCUs and hence the MCH services cannot be ensured on a daily basis at each clinic. During my field visit to the clinic in September 2004, the staff who was working before had started a study leave, and I could only meet the other staff who was still on maternity leave, at her home. At both Tumbe and Shumba Viamboni PHCUs, the MCH staff claimed that they couldn't work alone and accurately record the information about the clients. At both the clinics, I observed that the staff frequently forget to fill the nutritional assessment tick sheets. Also, it is very common for them not to fill the children vaccination and growth assessment card, and instead

they just record the weight in a book. This is most of the time done if the card is going to be used for the first time. Staff from the different HCFs had almost similar opinions on the matter,

> *You see the problem here is when you are alone. You sometimes can forget many things. Here you see I am on maternity-leave and the other one is on study-leave when you come back then the works are waiting for you. It is very difficult.*
>
> *(Health service provider, Micheweni District, September 2004)*

> *You see here three [Family Planning] clients will come but they will not get services and they will have to go to another clinic. There will be gaps here [on data filling] until an employee will be allocated to the clinic and she will fill the data according to the [small] card brought by the client.*
>
> *(Health service provider, Micheweni District, September 2004)*

> *When you are alone it is very busy here. You will realise it is 10:00 AM but you have not started vaccinating any person. You are just filling forms and people start shouting at you.*
>
> *(Health service provider, Micheweni District, September 2004)*

6.2.2 Material resources

These are other issues that have impact on the performance of HIS in the district. These include the physical condition of the HCFs, the storage system and availability of resources such as photocopy machines to at least the DHMT or the hospital. The file storage system is entirely poor in all the HCFs I visited with the exception of MCH clinic at Micheweni Cottage Hospital where a shelf is used. Files are usually stored on the table along with drugs and contraceptives. The same table is used when dealing with clients. At Shumba Viamboni PHCU, the situation is worse, as the physical condition of the HCF is very poor. At the DHMT office, at least there is a shelf for paper files storage (Photo 6.2).

Photo 6.2: File storage system at Micheweni DHMT office (Photographer: Author, September 2004)

There are no photocopy services at the DHMT office but this can be accessed at another nearby office at one's own expenses and hence is rarely used. At Tumbe and Shumba Viamboni PHCUs, there are no photocopy services at all; even electricity is problem at Shumba Viamboni. Absence of photocopy services causes problems for the availability of data collection tools. While the forms are usually sent in pairs, it is very common for the HCFs to lose one or for it to get destroyed in bad luck. At Micheweni Cottage Hospital, the MCH clinic sometimes used typed forms instead of just photocopying the original. This leads to the loss of the standard format. At both Tumbe and Shumba Vyamboni PHCUs, staff used handwritten forms, a problem which could be solved if there were photocopy services available at the DHMT.

6.2.3 Transport and Communication

Distribution of supplies, including of the data collection forms, is done by the DHMT every month. In this way, transport is an important issue at the district level more than for the individual HCFs. However there is a need for effective communication systems between the HCFs and the DHMT.

At the DHMT office, there is a car that was originally owned by Micheweni Cottage Hospital, which is used for the distribution of the forms, conduct supervision, and for the outreach programmes. Also, the EPI Programme sends a car at the start of every month for the distribution of supplies and for collecting the forms. There is limited amount of fuel supplied by EPI and Family Planning programmes totalling up to 80 litres each month.

Telephone is a very important tool for communication from the HCFs because of the poor transport facilities there. However, there are no telephones given to either the DHMT staff or to those at the HCFs. Staff use their personal mobile, which they recharge on their own expenses. At Shumba Viamboni PHCU, none of the staff own a personal mobile phone.

6.2.4 Financial resources

The above-mentioned issues are in one way or another related to the inadequate financial resources. In all the HCFs I visited and at the DHMT office, this was frequently mentioned as a critical problem to the implementation of HIS, leading to for example, shortage of forms and lack of necessary stationery for daily data operations. Staff had the following opinions on the matter:

> *I am supposed to prepare these graphs and charts but there are no resources. No stationeries.*
>
> *(Health service provider, Micheweni District, September 2004)*

> *Forms are usually sent in pair and when you do mistake is like what you see [pointing to the rough paper used to prepare reports locally]. I usually ask them can't you do mistakes? Their answer is "There are very few forms". Here are the results.*
>
> *(Health service provider, Micheweni District, August 2004)*

We do not have calculators. If you have calculator then it is easy to summarise but you need to buy books and then calculator! We do not have money.

(Health service provider, Micheweni District, August 2004)

6.3 Situation analysis of HIS

In this section, I describe the situation analysis of HIS in the district, as reported from the HCFs and the DHMT. The situation analysis covers the information process through data collection, analysis, reporting, information use at the HCFs and the DHMT and the feedback system.

6.3.1 Data collection

The same as to North 'A' District, the health workers primarily collect routine primary healthcare data at the HCFs. The data collected are for the outpatients, consumption of medicines and data from the MCH clinic including EPI, antenatal care (ANC), children attendances, nutritional assessments, surveillance for immunizeable diseases and family planning. TBAs also contribute to the primary healthcare data collected. From all the three health facilities I visited, TBAs use normal exercise books to record all deliveries they attend and send the books to the MCH clinic every month. Information recorded in these books is almost the same as what are recorded at hospitals, but in Swahili instead of English. However, the TBAs who record data and report to the HCFs are only those who were trained by the Ministry of Health.

All five TBAs I interviewed cannot read and write. They usually ask their children or their neighbours' children to record once they attend any delivery, or sometimes they can go direct to the clinic for recording. While delivery data were fairly filled, mortality data were often unfilled, as some of the TBAs interviewed did not even understand the meaning of maternal and infant deaths. This was also the case with some MCH Aides working at the clinics. Explaining about the maternal death, one TBA stated the following.

We are always careful. There are sign that when you see them then you must send her to hospital and also if she bleeds much then you hurry her to hospital… If she does not have any problem, [if she dies] then we take it as just God's plan [that is it is normal death but not maternal death]

(TBA Micheweni District, September 2004)

Tools used to collect data

Different forms and registers are used as the primary data collection tools at the HCF level. Some forms and registers are already formatted but others are locally prepared at the HCFs using normal exercise books. Tools are usually supplied by DHMT with the exception of the Stroke-forms that are collected by staff from the Ministry head office at Wete when the staff go to collect salaries. However it has been agreed that the Stroke-forms must also be supplied by the DHMT. While Stroke-forms are

usually supplied in adequate amounts, forms at the MCH clinics are usually supplied in a pair of two copies each month for every HCF. This can be a problem in case one or both copies are destroyed or lost. In this case, or in other shortage case, the staff at the HCFs may prepare the form by hand. An MCH Aide in one clinic emphasised:

> *Forms are usually sent in pair and when you do mistake is like what you see [pointing to the rough paper used to prepare reports locally]. I usually ask them can't you do mistakes? Their answer is "There are very few forms". Here are the results.*
>
> *(Health service provider, Micheweni District, August 2004)*

Another important tool for data collection and which is used most often is the children's vaccination card. However, the staff from two out of three MCH clinics visited claimed absence of the cards since January 2004. Instead, the staff use normal exercise books to record weight, and to assess the trend of growth they have to compare the weight they recorded into a big card displayed on wall (Photo 6.3). Although some people can buy the cards most people cannot. One staff at the MCH clinic explained the problem the following way.

> *People are resistant to buy exercise books. What about cards…but this also depends on the people, e.g. teachers will buy cards [for their children] but other normal people will not…this deficiency of cards has been reported to EPI but they did not respond. Before this total deficiency EPI were supplying only 25 vaccination cards every month. However this amount was not sufficient for this clinic.*
>
> *(Health service provider, Micheweni District, September 2004)*

Photo 6.3: Big vaccination card displayed on wall (Photographer: Author September 2004)

Most staff had no complaints about the simplicity of the forms, except for the family planning forms and registers. Different staff described the issue as follows:

The [monthly] report itself has very small fonts and you cannot read properly. Their services consume much time to provide and you also need to spend much more time on filling forms and books. They give many jobs, as if, they are the Ministry [of health].

(Health service provider, Micheweni District, August 2004)

Actually family planning [recording] is very difficult. They will always teach but it will remain to be difficult. After all we do not have enough staff as in Tanzania Mainland where the form comes from.

(Health service provider, Micheweni District, September 2004)

Table 6.3 summarizes some basic PHC data collection tools being used at the HCF level for different programmes.

Form/Register	**Category and purpose**	**Formatted by the supplier**	**Supplied by**	**Availability**
Immunization register	EPI – used to register new babies taking vaccines who live in the catchment area.	Yes, but sometimes extra fields may be added locally	DHMT from EPI	Reported to be always available
ANC register	EPI – used to register pregnant mothers attending ANC clinic, who lives in the catchment area.	No, locally prepared using exercise book	DHMT	Reported to be always available
Fomu ya muoanisho wa chanjo na Vitamin A (Vaccination and Vitamin A supplementation form)	EPI – a tick sheet used to record all children and mothers who took vaccines or Vitamin A supplement	Yes	DHMT from EPI	Most of the time, if not available a locally prepared one is used
Family planning register	FP – used to register family planning clients. This is MTUHA book	Yes, but fields not reflecting local needs.	DHMT from Family Planning	Most of the time.
Day-to-day book	FP – used to record all	Yes, but fields do not reflect	DHMT from Family	Reported to be always

	services given to FP clients	local needs	Planning	available
FP ledger	FP – used to record contraceptives' stock at the clinic.	Normal ledger	DHMT from Family Planning	Most of the time
Patients' register	OPD – used to record all outpatients cases and whether if new case or re-attendance	No	DHMT	Reported to be always available
Stroke-forms	OPD – used to record (tick) all outpatients visiting HCF categorized by diseases, age and sex	Yes	Ministry of Health head office at Wete. DHMT expected to take responsibility.	Reported to be always available
Daily Dispensing Register	OPD – a ledger used to register all medicines used at OPD	Yes (1/3), No (2/3)	DHMT. DHMT receives from Medical Stores Department (MSD)	Reported to be always available
Ledger	OPD – used to record the stock of medicines at the HCF	Normal ledger	Medical Stores Department (MSD)	Still new to the HCFs. Came when the drugs start to be distributed.

Table 6.3: Basic PHC data collection tools used at the HCF level for different programmes. Source: Fieldwork Micheweni District, August – December 2004

There is no recording system for public health education provision neither is there for laboratory works.

Data storage

Of the three HCFs visited, only Micheweni Cottage Hospital had good file storage system where shelves are used to store the data files. At both Tumbe and Shumba Viamboni PHCUs, the OPD files and registers are stored in the same cabinet used to store medicines. However, at Shumba Viamboni PHCU, the cabinet is very small and old. The MCH clinics at both Tumbe and Shumba Viamboni, use the same table used for service delivery for file storage. The DHMT is a bit advanced where files are stored on a big shelf (Photo 6.2) and are usually kept in order.

6.3.2 Analysis of data

In this subsection, I describe the process of data analysis at both the HCF and the district level. In Micheweni District, the process of data analysis is generally lower compared to the North 'A' District.

At the HCF level

Generally the HCFs conduct very little analysis of the data they collected. All three HCFs visited, send the Stroke-forms in tallies to the Ministry head office without preparing any kind of summary. However, the HCFs record these data into small exercise book bought by the HCFs themselves. The staff claimed to use the data from these books for preparing monthly summaries, which are also used to create some graphs and charts. However, only Tumbe PHCU showed the use of these data where at least some previous years graphs were displayed. The remaining two HCFs did not prepare even a report to show the percentage of top ten diseases. In all of the three HCFs, staff claimed that they could not analyse the data because of the lack of stationeries.

> *I am supposed to prepare these graphs and charts but there are no resources. No stationeries.*
>
> *(Health service provider, Micheweni District, August 2004)*

> *There are no tools, no time and we don't have sufficient staff. It is not possible to conduct such analysis.*
>
> *(Health service provider, Micheweni District, August 2004)*

At the MCH clinics, there are different monthly reports produced. The reports are prepared from the summaries of the daily records. The monthly reports produced are described in the Table 6.4.

Report (monthly)	**Uses**	**Formatted when supplied to the HCFs**
Vaccination and Vitamin A report – a monthly summary of vaccination and Vitamin A supplementation to children, pregnant women and women in the reproductive age.	Sent to DHMT with a copy remaining at the HCF.	Yes, most of the time.
Taarifa za utendaji (vaccination assessment report) – a report and graphs showing the trends of vaccination to children and mothers in the cumulative of months. The graphs also show if the trend is in good position. Different graphs are drawn in different colours.	Displayed at MCH clinic of the HCFs	Yes but limited to only three vaccination for each graph while it may be needed to have more than three as in the case of Polio 0 to 3.

Monthly surveillance report (for immunizeable diseases) – used to show the number of immunizeable diseases cases reported together with the particulars of each patient	Sent to DHMT	Yes, most of the time.
MCH report (there is no specific name or ID) – a monthly summary of children and mothers' visits and problems.	Sent to DHMT with a copy remaining at the HCF.	Yes, most of the time.
Family planning report (there is no specific name or ID) – a monthly summary showing number of clients to FP services and the trends of contraceptives use.	Sent to DHMT	Yes but very poor.
Report and Request for Contraceptives – a subset of the family planning report formatted specifically to show contraceptives stock. This report comes from the National Family Planning Programme of the Ministry of Health Tanzania Mainland based in Dar es salaam, and is the one used by the Ministry of Health Tanzania Mainland.	Sent to DHMT	Yes.

Table 6.4: List of reports prepared at MCH clinics. Source: Fieldwork Micheweni District, August – December 2004.

At the district level

At the district level, data from different HCFs are usually summarised to form district reports for the different programs. District Public Health Officer (DPHO) and the District Public Health Nurse (DPHN) usually do this processing, often however with the help of other DHMT members. The two usually work in pair, one counting and then recording and the other summing using a calculator. While these staff claimed that they usually check the data for accuracy, however I observed numerous mistakes in the original data that comes from the HCFs. For example, in the MCH form, the sum of total visits (first visit + re-attendances) did not match with total number of children weighed and obtained Red[10], Grey[11] and Green[12]. Also the percentage of wastage in vaccines is most of the time calculated incorrectly.

The DHMT did not produce any graphs or charts for the district. During my first visit in August 2004, I was told that there is a plan to prepare an information board where reports and other information will be displayed. This office is still new, only

[10] Bad state for child growth
[11] Moderate child growth
[12] Good child growth

three months since they shifted to this office. However, the story remained the same whenever I re-visited the office, even after four months in December 2004.

6.3.3 Reporting and information flow

Two reporting procedures exist. The monthly reporting from the HCFs to the DHMT and from DHMT to the higher levels, and the quarterly and annual reporting from the DHMT to the Zonal office and the Ministry of Health's Pemba head office at Wete.

Up to the time of this study, the DHMT at Micheweni was receiving reports from MCH clinics only. The DHMT staff living in different places usually collected the forms at the beginning of every month. Otherwise, a car from the DHMT was used for collecting the forms when dropping supplies. Most HCFs sent the Stroke-forms directly to the Statistics Office at the Ministry of Health's Pemba head office. However, there was plan to schedule the Stroke-forms to DHMT. Table 6.4 shows the monthly reports prepared by the HCFs that are sent to the DHMT. Figure 6.2 shows the data flow process from the local level to the national level.

The DHMT basically prepares only three monthly district reports: EPI, family planning and MCH. The compiled family planning and EPI district reports are usually sent to their respective programme offices at Chake Chake and the MCH report is sent to the Nutrition Unit at Wete. Neither of the reports passes the Zonal office. The individual Stroke-forms for those HCFs collected are usually sent to the Statistics Office of the Ministry of Health's Pemba head office at Wete. The DHMT also prepares a district health profile report that is sent to the district administration every quarter.

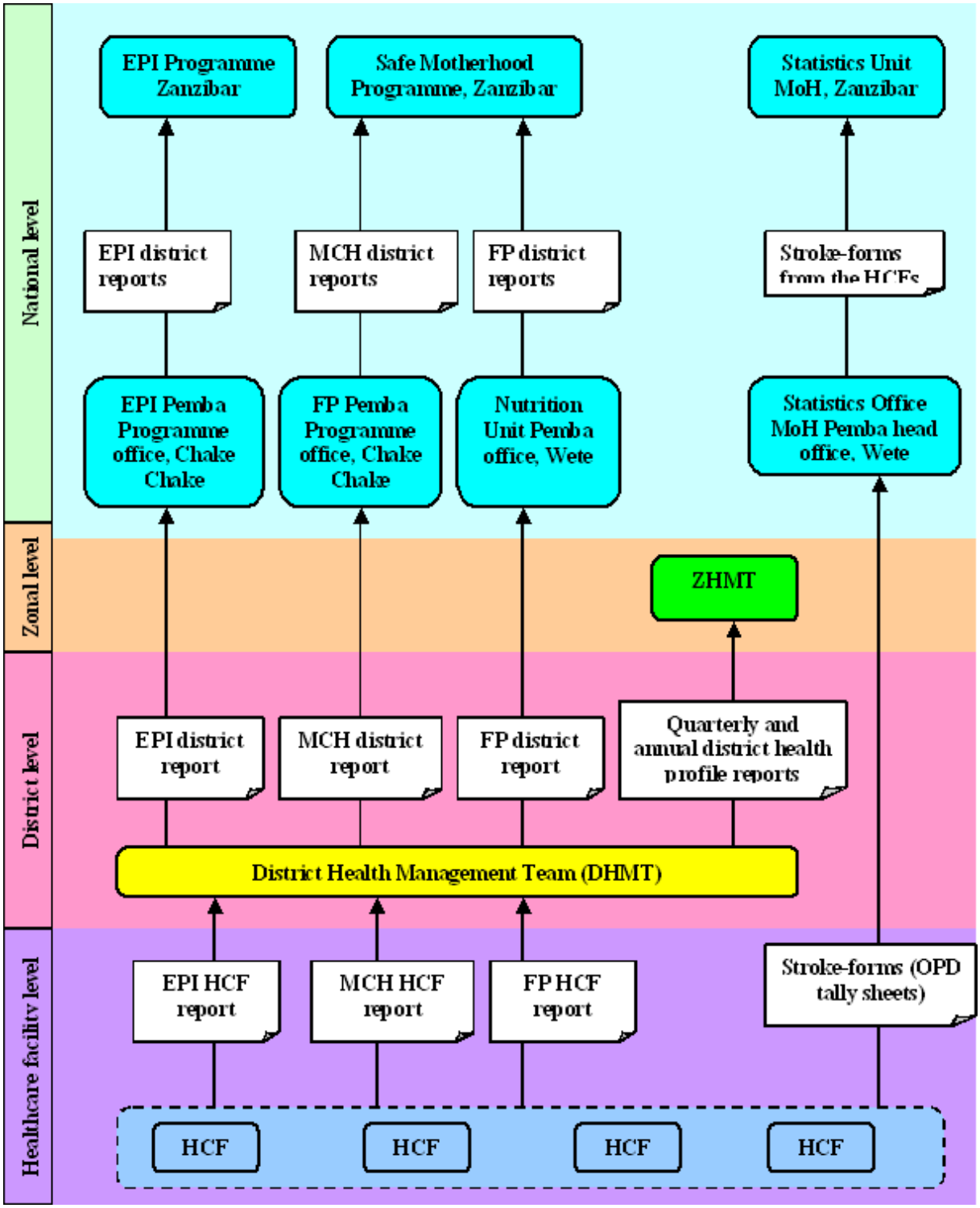


Figure 6.2: Data flow from the local level (Micheweni District) to the national level. Source: Fieldwork North 'A' District, July – December 2004.

6.3.4 Feedback and supervision

In this subsection, I explain the process of the feedback and supervision identified in the case study. The discussion is organized into three parts: feedback from the higher levels to the DHMT, from the DHMT to the HCFs and from the HCFs to the community.

To DHMT

EPI Programme usually gives feedback to the DHMT on what they are doing and they usually respond well whenever a request comes from the DHMT. However, for the rest of the programmes, that is, Family Planning and Nutrition Unit, there is no any feedback given to the DHMT. The same is to the case for the Zonal Office and the Ministry of Health's Pemba head office.

From DHMT to the HCFs

Usually there is a supervision programme for DHMT to HCFs. I also observed this in my visits to the DHMT office where most of the time I was told that the other staff were out for supervision or the outreach programme. However in all the three HCFs I visited, the staff claimed no feedback from the DHMT, stating that the DHMT responds only when they receive insufficient reports, and in the case of a disease outbreak.

From HCF to community

The main method used at the HCF to give feedback to the community is by providing public health education to the clinic attendants every morning, where in addition to the general public health education, specific problems identified are given special emphasis. Individual health education can also be given to the client at the time of receiving services when seen as important.

6.3.5 Information use

Both HCFs and the DHMT showed some efforts on the local use of information, in different levels of use.

At the HCF level

Same as to the North 'A' District, the information use for local managerial decision-making at almost all the HCFs visited is limited. At Micheweni Cottage Hospital, the staff explained the use of Stroke-forms when writing reports, and in fact they gave an example of a request based on data they generated where the inpatients data were used to secure more funds and staff for the hospital. At Tumbe PHCU, information is mainly used when arranging for public health education. In all the HCFs, the patients' prescription books are also useful sources of information when Prescribers need to decide whether the cases they attend are considered a new one or of re-attendances. The date of the last visit for that case is the information used for making this decision.

At the MCH clinics, staff always look on the trend of child's growth in the vaccination cards. In case of unsatisfactory growth, she gives individual health education to the affected person. However, I observed limitations of this application for those children who do not have cards. In this case, the staff could not easily go to the big card used for comparison, especially when there is high number of clients.

At the district level

The DHMT uses the information generated from the collected data mainly to check if the target was reached. In case of under performance, the DHMT identifies the underperforming HCFs and tries to find the possible causes so that they can react accordingly.

7
Introducing change

In this chapter, I present the discussion on the process of introducing change to the HIS in Zanzibar. Prior to this discussion, an inter-case comparison of the two cases is presented where the problems associated with the existing HIS, which are the main reasons for introducing change, are discussed. The chapter starts with discussion on the situation analysis of the HIS at the higher levels, that is, at the zonal and the national levels, in order to give a brief picture of the overall existing HIS operation in Zanzibar. The change process adopted, formed a basis for establishing HISP activities in Zanzibar. The chapter is organised as follows: In section 7.1, I present a brief situation analysis of the HIS at the higher levels, and the comparative discussion of the problems identified in the existing HIS is presented in section 7.2. The change process itself is presented in section 7.3. The process followed an action research approach, organised in the following subsections reflecting to the action research phases. Subsection 7.3.1 presents a discussion of the process of building the client-system infrastructure. The Diagnosing, action planning and action taking are presented in subsections 7.3.2, 7.3.3 and 7.3.4 respectively. The process of formulating human capacity building is presented in subsection 7.3.5, and finally I give brief description of the next phases of the research in subsection 7.3.6.

7.1 HIS at the higher levels

In this section, I briefly present the HIS situation analysis at the higher levels, that is, at the zonal level and the national level. The study revealed that the HIS at the higher levels is performing poorer even compared to the local level.

7.1.1 Zonal level

Zonal Health Management Teams (ZHMTs) are ideally supposed to collect and compile data from all districts comprising their respective zones. However, this has never been done. Routine reports are directly sent to the National level, that is, to the statistics offices of the Ministry of Health at the Ministry of Health's Pemba head office for Pemba, and at Mnazi Mmoja for Unguja. For the vertical programmes the data are sent directly to their programme offices at Chake Chake in Pemba and Mnazi Mmoja for Unguja. Only quarterly and annual reports are collected from the districts. These reports just show descriptions of district activities conducted and the general district health profiles but cannot be used for example to calculate any indicator. Figure 5.2 and Figure 6.2 show the working reporting system from the healthcare facility level to the national level, as studied from North 'A' District and Micheweni District respectively.

7.1.2 The National level

HIS at the national level is rather disorganised, with the main data collection programmes having their individual information systems. EPI Programme collects data from all districts, preparing their own reports, which are then sent to the EPI Regional Office in Nairobi. Safe Motherhood Programme collects family planning data and other MCH data. Family planning data are then sent to the Family Planning Headquarters in Dar es salaam. The Statistics Unit of the Ministry of Heallth is expected to be the central source of data and information to the Ministry. However, the section is the worst in terms of data collection and analysis. The office claims shortage of resources to such an extent that, the latest bulletin produced was in 2002. The office has a poor working environment and staff concentrate only on the stroke-forms. However, these data are most of the time incomplete, and it was reported that it might exceed six months for the stroke-forms to be sent from Pemba. Photo 7.1 shows file storage at the Statistics Office of the Ministry of Health.

Photo 7.1: File storage at the Statistics Office of the Ministry of Health (Photographer: Author, November 29, 2004)

7.2 Problems identified in the HIS – Comparing the cases

In this section, I present the problems identified in the study which undermine the performance of the existing HIS. Comparison between the two cases is made where similarities and differences are explained.

7.2.1 Scarcity of resources

Scarcity of resources including human resources, data collection and processing tools, stationeries, fund and other resources were identified in both the districts, with Micheweni District being worse. In both the districts, all the HCFs visited reported the problem of insufficient staff in number and qualifications. This has an impact on the process of data collection and analysis, since the crowded staff would most of the time give priority to service provisions rather than data recording.

As a formal procedure the distribution of EPI, family planning and MCH forms are usually supplied in a pair of two copies for each HCF, each month. Sometimes the forms get destroyed forcing staff to prepare the form by hand. At North 'A' District, the DHMT sometimes photocopied to have extra emergency copies but in Micheweni District the DHMT could not photocopy because of lack of funds. There is no funding scheme for HCFs, and the DHMTs do not get enough funds to buy stationery, necessary tools for data processing, and fuel for the DHMT car that is used for the distribution of medical and non-medical supplies. As a result, many HCFs did not prepare even simple graphs claiming the lack of resources.

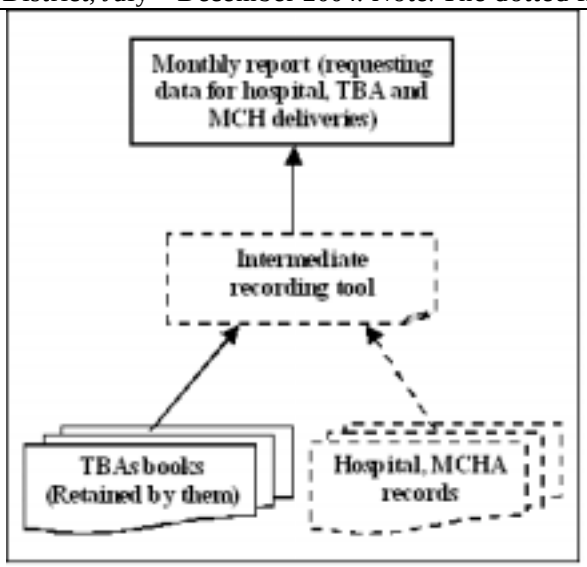
7.2.2 Gaps in data collection tools

The present HIS does not cover all necessary aspects in terms of data collection tools and reports. While the PHCU 2nd line and the PHCC (Cottage hospitals) are supposed to do laboratory examinations, there is no formal recording procedure organised in the HIS and neither is there for the special clinics at the cottage hospitals. Most registers are also not formatted. Staff have to prepare the registers using normal exercise books, and hence leading to lack of standards in the registers prepared. For example, the maternity ward at Micheweni Cottage Hospital record both patients with postnatal problems and sick pregnant women in one register while the maternity ward at Kivunge Cottage Hospital uses two different registers.

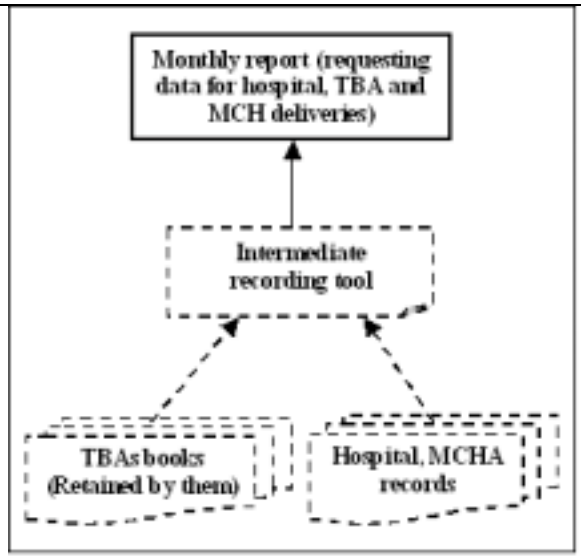
Another example is from the monthly report of Safe Motherhood Programme. While the delivery data from hospital, TBA, and MCH Aide are requested, there is no any recognized collection method for these data. In Micheweni District, the TBAs have books where they record the deliveries they attend. However, there is no intermediate tool to record this before registering in the monthly report since the TBAs retain their books. In North 'A' District, even these books are not present. Delivery data from hospital or by the MCH Aide are also not recorded anywhere recognised formally at the HCFs before making the monthly reports. Figure 7.1 gives a pictorial presentation of this. Information on maternal and infant mortalities is

never recorded within the PHC framework. Only hospitals record deaths happening at their specific institutions.

Figure 7.1: MCH data recording at HCF level. Source: Fieldwork at North 'A' District and Micheweni District, July – December 2004. Note: The dotted figures indicate absence.



Micheweni District – there is no intermediate recording tool from the source to the monthly report and there is no recorded source data for deliveries by MCH Aides or hospital



North 'A' District – neither the source data nor the intermediate recording procedure exist.

7.2.3 Poor analysis of data

It both the DHMTs and the HCFs, the analysis of the data collected is limited. In North 'A' District, only Kivunge Cottage Hospital showed reasonable improvement, where several graphs were produced in addition to the monthly reports from the MCH clinic, that is, for MCH, FP, and EPI services. However, the other two HCFs visited prepared only monthly reports for the MCH clinic that are sent to the DHMT, and the vaccination trends reports that are displayed on walls at the HCFs. The North 'A' DHMT also showed improvements where several graphs, tables and charts were prepared and displayed. At Micheweni District, neither the DHMT nor the HCFs visited, prepared any graph or chart apart from the vaccination trends reports that were displayed on walls at the HCFs. The only reports produced were monthly reports from the MCH clinic, where formatted forms usually exist. Only Tumbe PHCU showed tables and graphs of top ten diseases but not the recent ones.

Both DHMTs claimed that they usually check the forms from the HCFs. However, I analyzed the MCH monthly reports from all the HCFs, and observed some inconsistencies from almost all of the HCFs. For example, the total of children attending clinics, never matched with the sum of those who were weighed and categorized green, gray or red. Ideally the two must be equal. DHMT at North 'A' answered that they usually record the weight for re-attendants only. However, taking this definition (which senior officials did not agree with) I obtained the same results, except for Kivunge Cottage Hospital, which did not show much difference

based on this definition. Tables 7.1 and 7.2 show analysis of data for the period of January to September 2004 for Micheweni Cottage Hospital and Kivunge Cottage Hospital respectively. The analysis shows that there is deviation from the correct definition where the total visits must be equal to the total children weighed, and also the definition used by the DHMT in which the total re-attendances must be equal to the total children weighed. Figures 7.2 and 7.3 show the graphical presentation for the two HCFs. More graphs are shown in Appendix C.4.

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Total visits	175	157	239	181	254	239	279	269	230
Re-attendance	140	125	191	139	178	164	234	222	189
Total (Green, Grey, Red)	134	134	156	158	169	164	215	195	126
Difference between Total visits and Total (G, G, R)	21	23	83	23	85	75	64	74	104
Difference between Re-attendance and Total (G,G,R)	6	-9	35	-19	9	0	19	27	63

Table 7.1: Comparison of children attendances and growth assessment for Micheweni Cottage Hospital for the period of January – September 2004. Source Fieldwork at Micheweni District Health Management Team's Office, November 2004.

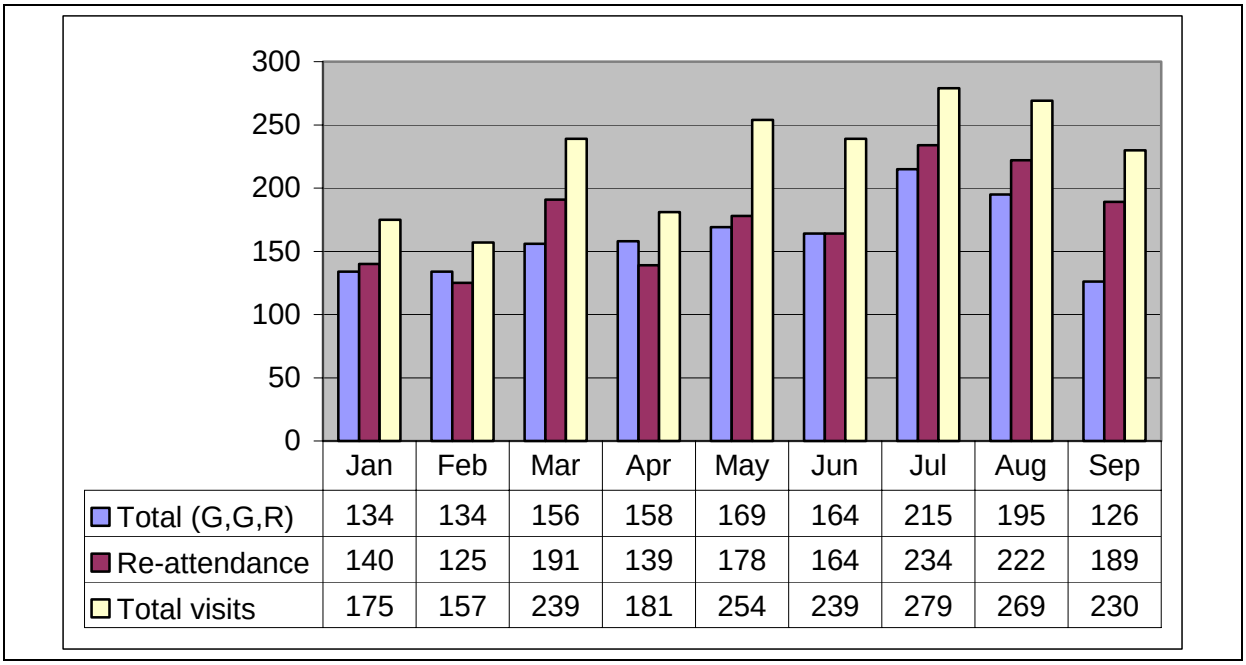


Figure 7.2: Graph showing comparison of children attendances and growth assessment for Micheweni Cottage Hospital for the period of January – September 2004. Source Fieldwork at Micheweni District Health Management Team's Office, November 2004.

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Total visits	671	736	860	786	711	881	855	1064	971
Re-attendance	631	696	816	722	643	812	795	992	898
Total (Green, Grey, Red)	631	NA	816	741	644	803	795	992	898
Difference between Total visits and Total (G, G, R)	40	40	44	64	68	69	60	72	73
Difference between Re-attendance and Total (G,G,R)	0	NA	0	19	-1	9	0	0	0

Table 7.2: Comparison of children attendances and growth assessment for Kivunge Cottage Hospital for the period of January – September 2004. Source Fieldwork at North 'A' District Health Management Team's Office, October 2004.
Note: NA means data were not available.

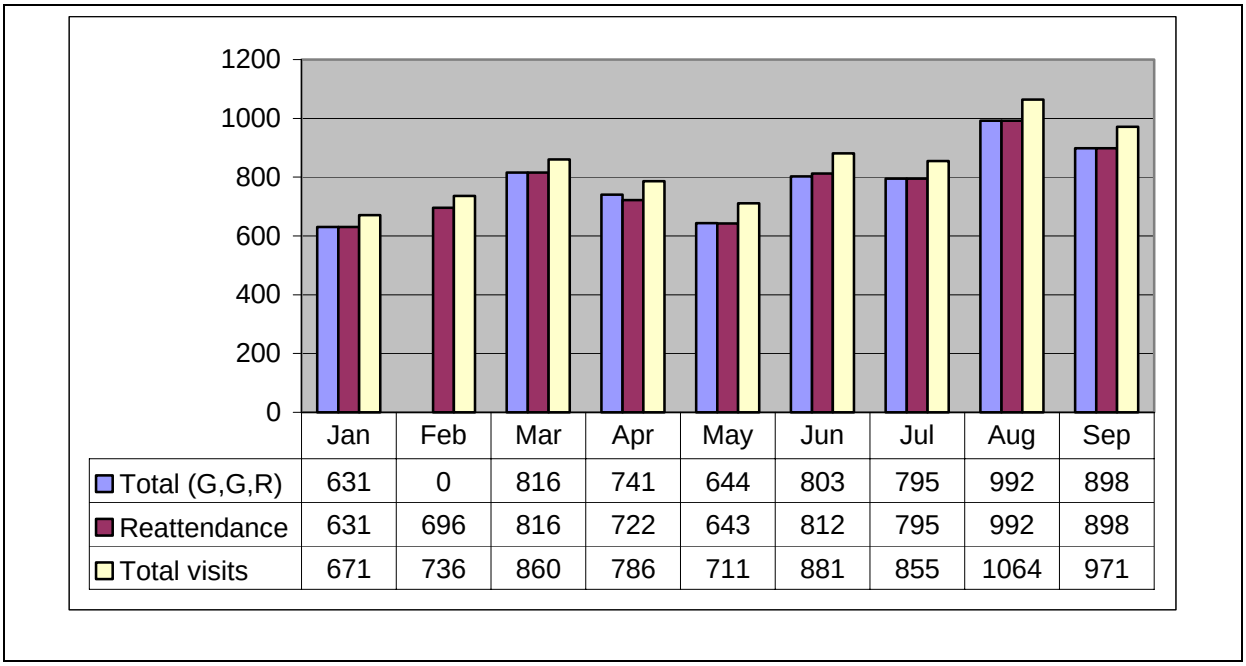


Figure 7.3: Graph showing comparison of children attendances and growth assessment for Kivunge Cottage Hospital for the period of January – September 2004. Source Fieldwork at North 'A' District Health Management Team's Office, October 2004.

7.2.4 Fragmentation at the higher levels

While the districts act as the central data centre at the local level where all HCFs report to the DHMT, the HIS at the higher levels is totally fragmented. DHMTs report different data to different vertical health programmes and also to the Statistics Unit of the Ministry of Health. None of these data pass at the either of the zones. This fragmentation makes it impossible to create a central data pool where the Ministry and other stakeholders could get all health data. Figure 7.4 gives a pictorial presentation of the reporting process from the HCFs to the DHMTs and from the DHMT to the higher levels.

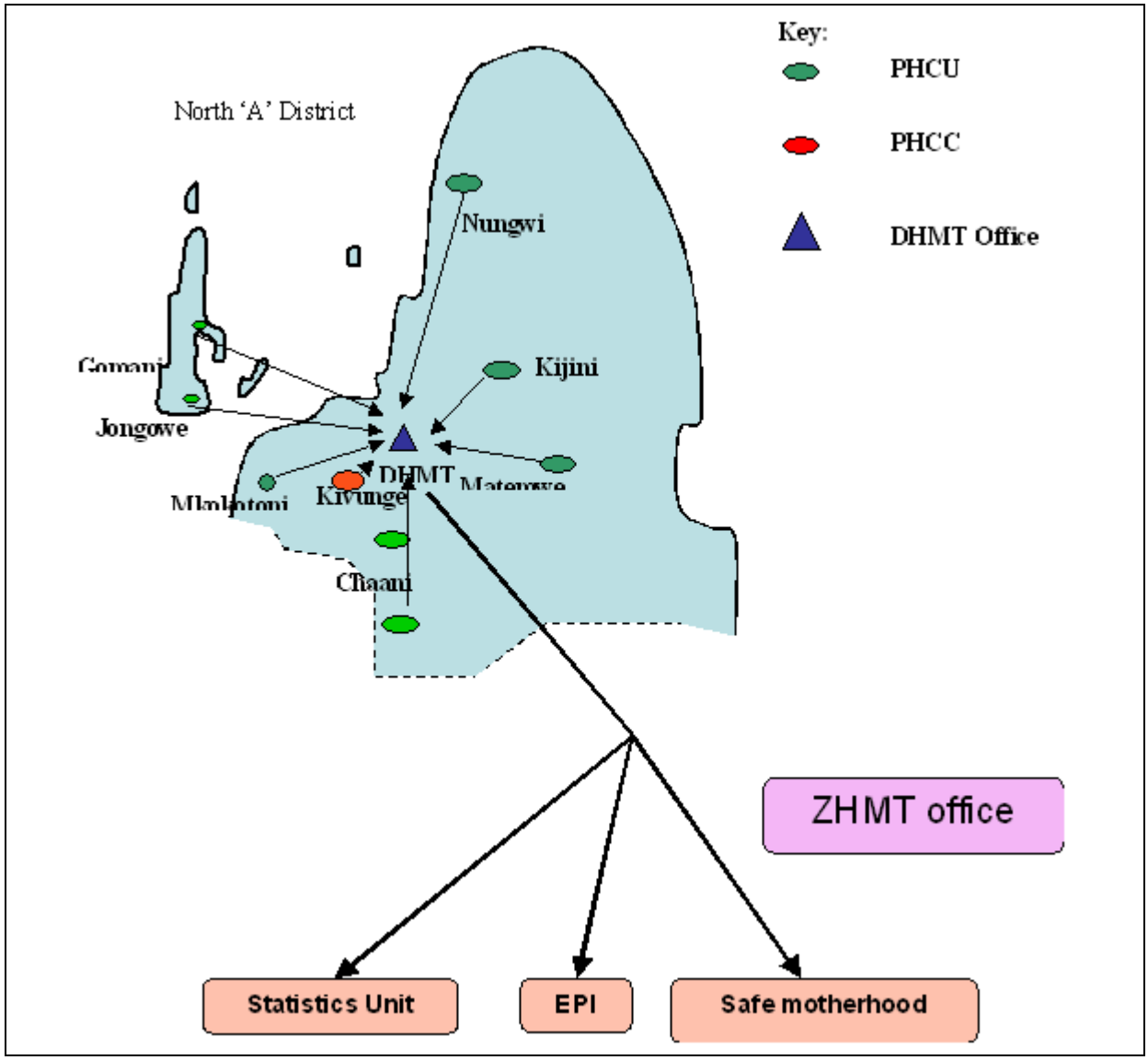


Figure 7.4: Reporting procedure from the healthcare facilities to the district level and from the district level to the higher levels. North 'A' District is taken as an example. The process converges and then diverges. Source: Fieldwork North 'A' and Micheweni districts, July – December 2004.

7.2.5 Poor feedback and lack of motivation

Generally there is poor feedback from the higher levels to the lower levels. In both districts, the staff at the DHMTs claimed no feedback from the Ministry, the ZHMTs and from the programmes that receive data from them. Only Micheweni DHMT acknowledged that the EPI Programme responds well to the requests they made. Both the DHMTs have routine supervision programme to the HCFs. However, the HCFs claimed the only feedback they get from DHMT is by blaming them when they send insufficient reports. This also shows more efforts were taken at the local levels where the DHMTs conduct supervision while this was not the case for the higher levels to the DHMTs. Poor feedback may lead to demoralizing the staff at the HCFs, which may result into poor data.

7.2.6 Limited information use

The information use for managerial decision-making is still minimum in both the HCF and the district levels. However, some HCFs and the North 'A' DHMT showed some efforts on the use of information, though limited. At the HCFs only basic use of information, such as monitoring the progress of baby's weight was conducted when the babies visited the MCH clinics. The Prescribers also used the information to identify case type, that is, whether is new case or re-attendance when they attended patients. In one circumstance, Mkokotoni PHCU prepared a map which they used for monitoring diarrhea outbreak in 2003 (see figure 5.3).

However, in both districts neither of the HCFs visited, used the information for monitoring the trends of prevailing diseases. Only Kivuge cottage hospital, explained that they used the information they have to evaluate the efficiency of services they provide. The DHMT at Micheweni did not show any sign of information use. North 'A' DHMT is a bit advanced compared to Micheweni case, where they at least present information showing for example immunization status of the district and the district health status. However, the only decision they can make is to organize meetings to provide public health education where staff have to volunteer, since the DHMT does not have enough fund for that programme.

7.3 Introducing changes

Three issues determined the process of introducing changes to the existing HIS in Zanzibar: my research which aimed at studying and improving the current HIS situation in Zanzibar; the Ministry's desire and capability for change; and the lessons and experience I learned from HISP activities in different countries. Balancing between the three, I developed an action research cycle as shown in figure 7.5. The deployment of my research plan relied significantly on the Ministry's plans, which could not enable me to begin some phases of my research within the my fieldwork period. The Ministry's plan also relied on the readiness of the other stakeholders, such as the Danish International Development Agency (DANIDA) which is the Ministry's main sponsor and the World Health Organization (WHO). In this way, I could only go through the diagnosing, action planning and action taking phases. The two phases of evaluating and specifying learning could not be conducted within the fixed timeframe, but are documented in this thesis.

The diagnosing phase constitutes the initial situation analysis of HIS I conducted and the one-week study conducted by the joint consultancy team, which I also participated. The action-planning phase represents the plan prepared by the joint consultancy team that was discussed and agreed in the stakeholders' workshop on the way forward for the HMIS. This workshop was conducted after the fieldwork conducted by the consultants. The action-taking phase represent the work carried out by the two selected technical teams, one responsible for revising the new HMIS forms and the other for the computerization of the new HMIS using the DHIS software. I participated in both teams in different times.

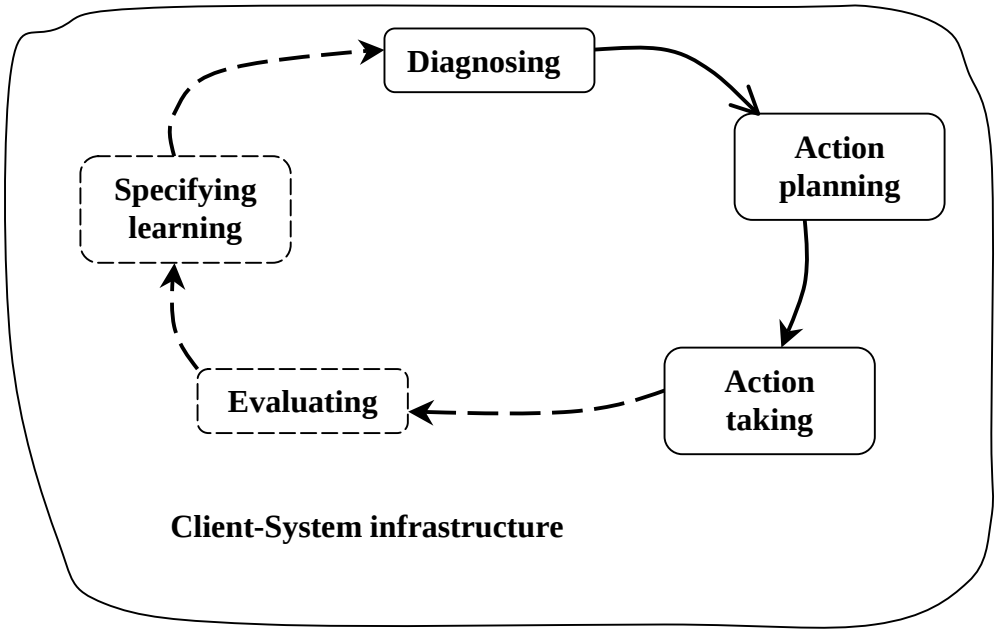


Figure 7.5: Action research cycle adopted in the study. Adapted from Baskerville (1999:14)

7.3.1 Setup for changes – Building the Client-System Infrastructure

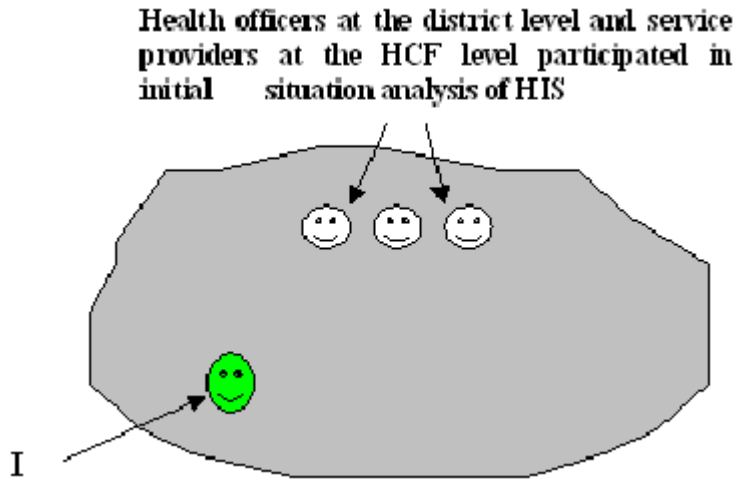
The client-system infrastructure is the specification and agreement that constitutes the research environment, and needs to be well established in the early stages of any action research. While struggling for permission to do the research the most frequently asked question was, "*How will the Ministry benefit from your research?*" I had to clearly explain that the practical contribution of the research would be the automation of HMIS using the DHIS software according to the local needs. After the permission was granted, the same question was repeated whenever I was introducing myself to the top officials. My gate keeper, who is a key person in the HMIS and policy development, answered for me, "*This is a local expert, he is studying now and in his research he will assist us in our HMIS, and he will develop software for us*". However, following this answer I needed to clarify that I will not develop new software, and instead I will use a readily available software which I may need to customize according to the local requirements.

As a strategy to develop a conducive working environment, I managed to present the software to the Executive Committee[13] of the Ministry, and the Principal Secretary gave a go ahead. Before this presentation, I had a series of conversations and presentations to the key HMIS developers and staff at the Planning Unit. In addition to the permission I was granted, the Ministry also gave me a letter that requires staff to cooperate and give any necessary assistance. Staff at different levels responded well, and I learned many new things from them. In the action research approach, these practitioners were the main participants with whom we worked in different stages of the research.

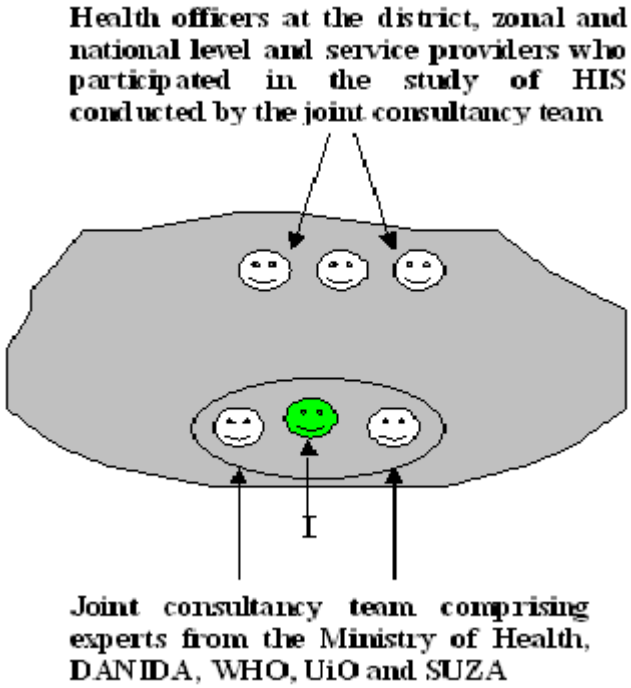
[13] Committee of the Ministry comprised of heads of all departments chaired by the Principal Secretary.

Photo 7.2: The Executive Committee meeting, August 12, 2004. The Principal Secretary (the first right in the opposite side) and other attendants listening to the Professor from the University of Oslo discussing something regarding my presentation. (Photographer: Ali Hassan)

Another group of participants became involved in the action-planning phase. In this phase, the number of researchers participating in the research was increased. As a strategy to involve major stakeholders, the Ministry in collaboration with DANIDA, organized a joint consultancy that will study the existing HIS and deploy knowledge and experiences from different experts. A joint team was formed comprising both scientific and organizational researchers, from major supporters of the Ministry such as DANIDA and the WHO, University of Oslo and some officials from the Ministry of Health. Later in the action taking phase I worked with a smaller but more specialized team comprising of the Head of HMIS Section, the Statistics Officer, three key people who participated in the design of the new HMIS, a PhD researcher from the University of Oslo (UiO) and one person from the State University of Zanzibar (SUZA). The team was split into two, the first group dealing with the software and the second group dealing with the paper forms. I circulated between the two teams working in different times.



The initial team in the diagnosing phase



Extended team for the diagnosing phase

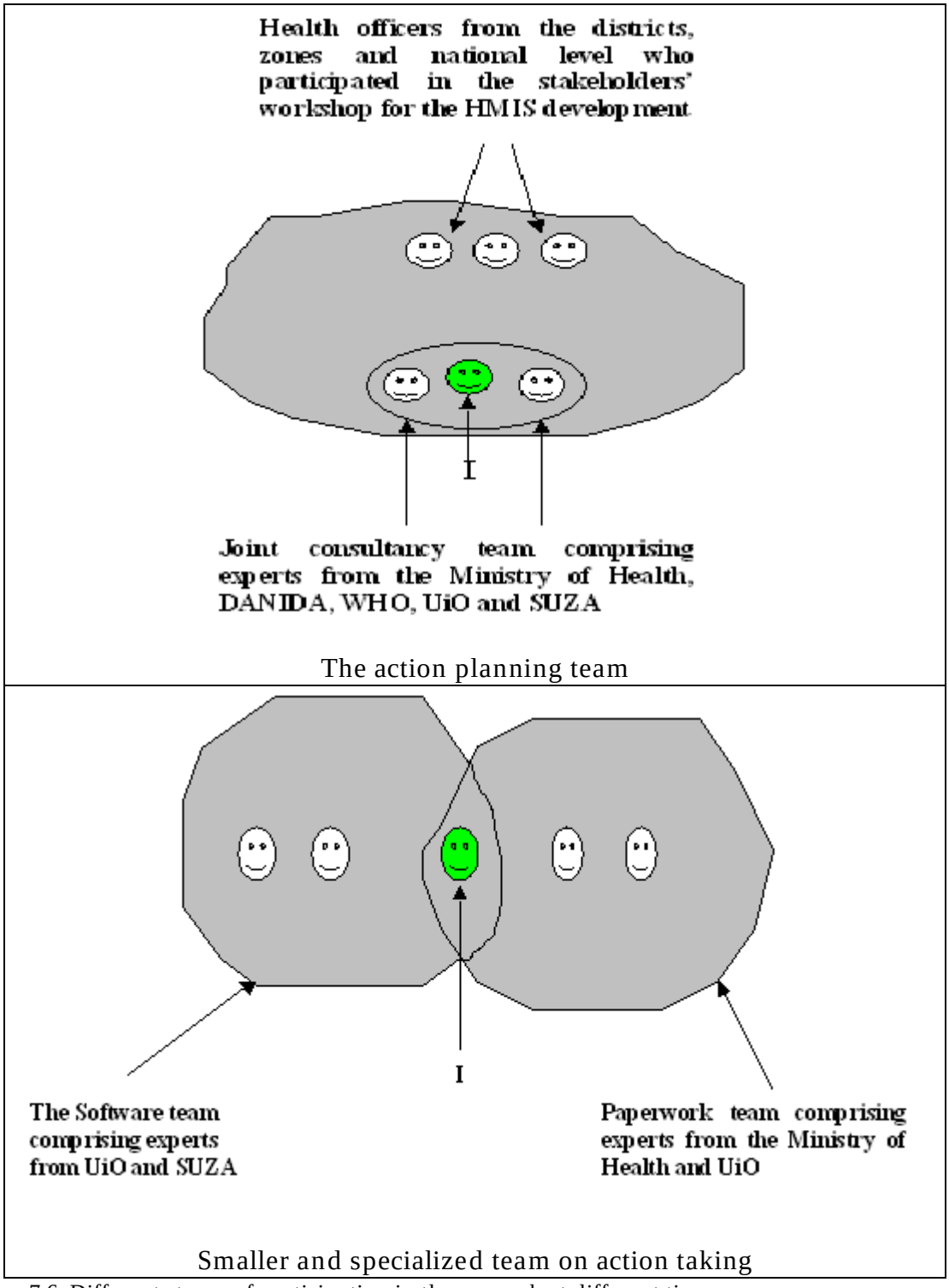


Figure 7.6: Different stages of participation in the research at different times

7.3.2 Identifying the problems – Diagnosing

The diagnosing phase involves the initial situation analysis of HIS I conducted, and the study conducted by the joint consultancy team, of which I was a member. In both studies, it was discovered that the existing HIS was not functioning properly. The problems identified include scarcity in data collection and storage tools, poor coverage of the HIS, poor data analysis and limited information use, fragmentation

especially at the higher levels and the problem of human and financial resources. It was stated that, the main reason that resulted the stated problems is lack of a clear information policy. The problems are also associated with the lack of modern data storage and analysis tools, and the inadequate financial support.

The solution proposed was mainly to tackle the technical development aspect, rather than the policy development aspect. The main suggestion given was to start the deployment of the new HMIS forms that stopped for a period, and to establish computer based data storage and processing system. It was suggested to use the DHIS software, which is readily available software. By proposing this solution, two assumptions were made. First, by starting the deployment of the new HMIS forms the Ministry will have an integrated tool for data collection. All data will follow the same reporting channel to the HMIS office, which will be the central data pool for all programmes. Second, the computer software would increase efficiency in data processing and reporting. However, three challenges were identified: 1) how the different health programmes will agree with the deployment of the new HMIS; 2) the budget for deployment; and 3) how to arrange for an efficient technical assistance for the implementation of the DHIS software.

7.3.3 Planning for changes – action planning

The joint consultancy team prepared a draft of a long-term strategic plan called "Roadmap" and the task force to drive it. Later the Roadmap was discussed through a stakeholders' workshop on the way forward for the HMIS held on December 4, 2004. In this workshop, 35 participants attended including the consultancy team. The participants included representatives from different vertical health programmes, Statistics and Epidemiology Units, Mnazi Mmoja Central Hospital, Pemba ZHMT, Unguja ZHMT and representatives from two DHMTs (North 'A' and North 'B'). In this workshop, three presentations were made. The WHO representatives presented the findings of the study conducted by the joint consultancy team, the WHO experience on HIS from different countries. Finding from the initial situation analysis of HIS I conducted were also incorporated in this presentation. The HISP project leader from the University of Oslo presented HISP experience, and I presented the Roadmap and how the DHIS software can support it.

After those presentations two groups were formed. Each group had to discuss important things about the presented topics and give suggestions on how to better improve the HMIS. Two points raised significant discussion. First, the coverage of the forms where many participants discussed how the delivery data (Hospital, TBA and MCHA) are collected before they are recorded into the monthly MCH form, and whether to include TBA data. Finally it was agreed to include the TBA data and to create a tool to collect data from TBAs as well as the hospital and MCHA delivery data. Second, questions were raised regarding how the DHIS software will be reliable in both data-handling and processing and its sustainability in terms of technical capability. Participants were also in doubt about the validation procedures. Even though I had explained these in my presentation, I had to provide further

clarification on the built-in validation features of the software. For the technical assistance, I had to give a commitment to researchers from the University of Oslo including my self and our fellow from the State University of Zanzibar.

At the end of meeting the Roadmap (Appendix D.1) was passed with minor changes. The Roadmap detailed all the tasks to be carried out, the responsible people and budget allocation in every step of implementation. To begin the deployment of the new HMIS, it was agreed to start with three pilot districts of North 'A' and North 'B' on Unguja Island and Micheweni District on Pemba Island. Regarding the implementation of the DHIS software it was agreed to start in one pilot district of North 'A' on Unguja Island.

WHO representative doing presentation

Chairman (center) introducing me (left) before I present. To the right is DANIDA Senior Health Advisor

Professor from UiO (standing) presenting

Participants


Group discussion (Group A)


Group discussion (Group B)

Photo 7.3: Stakeholders' workshop on the way forward for the HMIS at Aecrotanal Hall Zanzibar, December 4, 2004. (Photographer: Terkel Budolfsen)

7.3.4 Action taking

This was a very short period due to the deadline to my research period. The implementation period of the Roadmap starts January 2005 and hence we had this pre-roadmap period where the main activities were to create a conducive environment for the Roadmap. Two technical teams were formed, the first team dealing with the paper forms, and the second team dealing with the software preparations. Within the limited time, I worked in both teams at different times. I had a temporary office in the DANIDA Health Sector Programme Support office sitting at a roundtable the whole day long. Both teams were meeting in this office.

7.3.4.1 The paperwork

In the paperwork, we began by reviewing the new HMIS forms starting with the patients' registers, the stroke-form which we later titled "OPD tally sheet" together with its monthly report and then the EPI tick-sheet with its monthly report. The aim here was to revise the forms so that the health staff will collect data for the minimum datasets and that will be simpler to use. We were also looking at the continuity of the forms, that is, how the monthly reports could directly map their respective data collection forms (e.g., from the OPD tally sheet to the OPD monthly report)

The Patients' registers remained unchanged in the proposed structure in the new HMIS.

The OPD tally sheet with its monthly report. The Head of HMIS, a medical doctor, led the discussion of the revision of the OPD tally sheet. The forms changed very much. In the original stroke-form from the old system, tallies were used but in the new system 00s were proposed. However, we later agreed that strokes are better because we can save space and because Prescribers are used to strokes. We also discovered that some important diseases were not included and hence we had to include them. The age categorization was changed mainly following special care given to different groups of children (0-12 years) and to consider adults as only one group (12+). The following age categories (0-1,1-5, 5-12 and 12+) took the place of the

categories proposed earlier (0-4, 5-14, 15-24, and 25+). The sex categorization and the case type remained. The number of data elements increased a bit following the inclusion of additional diseases. We also changed the arrangement of the diseases with those having high prevalence coming first.

The EPI report and tick sheet remained the same as the proposed one. The data elements here were reduced to half of what is collected now with old forms, with the agreement of the responsible persons of the programme.

The process to carry on revise the rest of the forms was planned to carry on when I left.

7.3.4.2 The software work

The software technical team comprising university researchers from UiO and SUZA were responsible for the software development of the new HMIS, where the DHIS software will be adapted for the purpose. The activities conducted here are mainly divided into two groups: the process of identifying the data elements to be included and the software configuration and database building.

The implementation strategy

The team approached the implementation process by preparing a technical report for the implementation of DHIS (Appendix D.2), which will be the guideline based on the Roadmap. The technical report was submitted to the DANIDA Senior Health Advisor and to the 'informal secretariat' for the task force. In this report, the team proposed an incremental approach where two programmes (EPI and Safe Motherhood) will be included for the initial six months (Jan – July 2005) in one pilot district of North 'A', where the new HMIS forms will also be prototyped. The remaining programmes will be included in the next phase of HMIS forms rolling out from July 2005. The team also proposed to conduct a feasibility study for a GIS application during the same period of HMIS forms rolling out.

The team also decided to develop a different user interface for the OPD form. This form is very complicated with diseases organized in rows. Each disease is categorized in sex and age groups, and in new cases and re-attendances organized in columns. The form had 30 diseases organized in rows, each with 16 categories organized in columns. This forms 480 (30 X 16) data elements that are subject to change. Technically, it was realized that to use the DHIS data entry screen for these data would not be efficient since there would be a long list of data elements generated from just one form. Therefore, we decided to develop a data entry screen that will be exactly similar to the OPD form. A quick and simpler development idea was to hard-code the proposed data entry screen. For the rest of the data, the DHIS data entry screen will be used.

However, the secretariat posed a question for discussion concerning "Why not start with the OPD form which is the Ministry's main concern on surveillance data?". The two programmes were selected because the data elements from the two programmes were more stable, and the software is readily available for the data from these

programmes. On the other hand, the OPD form is not stable and is expected to require more changes. This would cause more problems for the development processes because we would need to reprogram the data entry form whenever it is changed, since the form will be hard-corded. In addition to this, the software technical team realized that the development work for the new OPD data entry form would not be completed before January, when the system is required to start to be used. In the end, the secretariat agreed with our suggestions and took responsibility for defending this to the task force and the Ministry. Meanwhile, the HISP project leader from the University of Oslo was preparing a comprehensive project proposal and plan.

The process of identifying the dataset

Even after the forms have been reviewed, it was not a simple mapping process from the paper forms to the database. Therefore, we set and identify which fields are to be included in the database as data elements, and which will be recorded as semi-permanent data. Our intention was to begin by working through two forms, EPI and Safe Motherhood. However, we only had time to work through the EPI form since the Safe Motherhood form was not yet revised, and furthermore, the form was not very clear to us and there was no one who could explain it us. The EPI form led to 17 data elements that are displayed in figure 7.7. The team agreed to work with indicators latter but not within the prescribed short time we had.

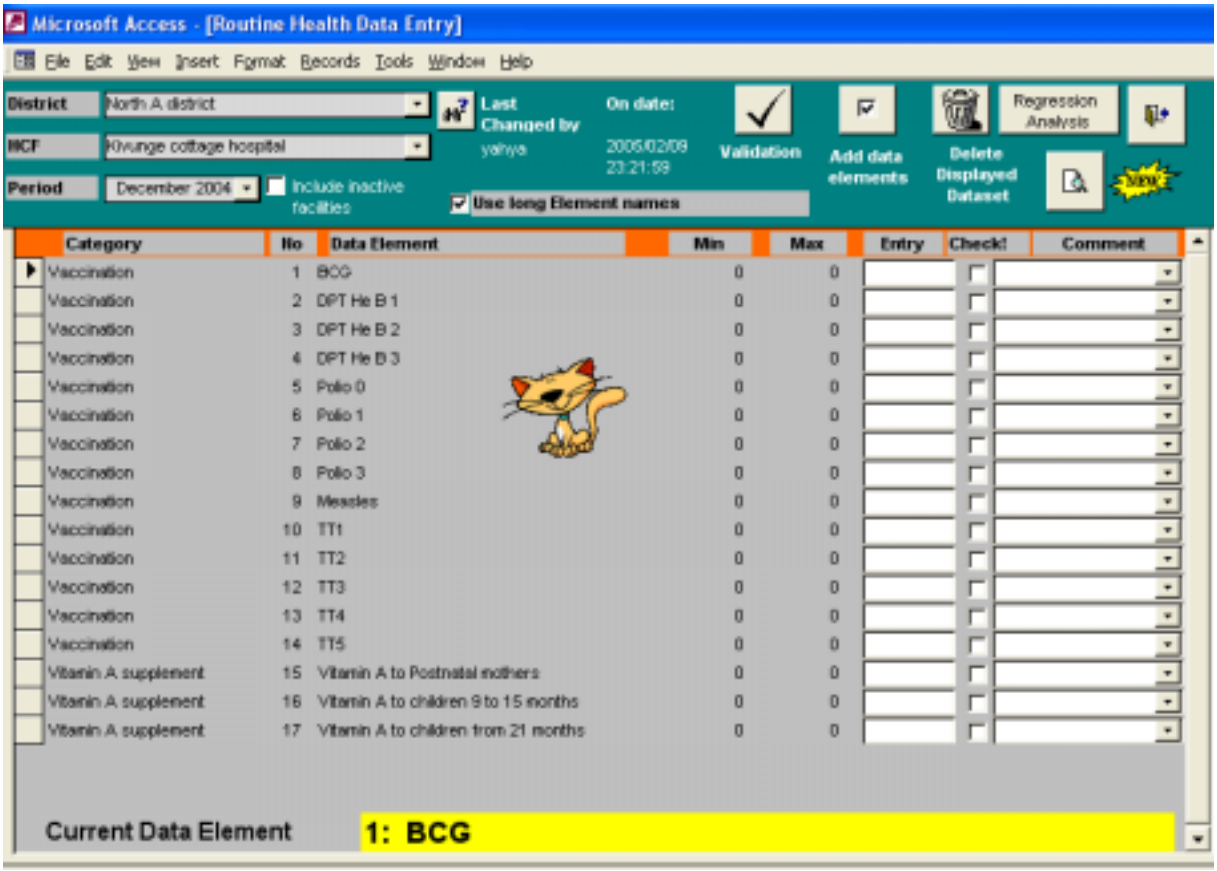


Figure 7.7: Data elements that were registered in DHIS. Source: Fieldwork December 2004.

Software configuration

The team then started to create the database for the selected pilot district of North 'A'. In this period, we were using our own laptops to create the database since this will require only copying the database to the specified computer when the process of software configuration at the districts begins. We began by registering the health facilities in their respective parent district (North 'A'), and later we registered the data elements from the already reviewed form of EPI (see figure 7.7).

7.3.5 Human capacity-building

Human capacity-building both at the user level and technical level is very important in order to ensure sustainability. It was realized that sustainability could not be guaranteed without having technical personnel within the Ministry. Therefore, the team proposed that the technical team should include one person from the Ministry who will be technically trained in order to give immediate support when other team members are not present, a circumstance that is likely to occur.

It was also agreed at the Ministry that six people will be sent to Dar es salaam to attend a HIS course, as an initial effort for capacity-building. It was proposed to select key people in HMIS who are likely to be users of the system including people from the two pilot districts. The Ministry of Health with support from the DANIDA Health Sector Support Programme will sponsor the students.

7.3.6 The next phases

The two last phases that complete an action research cycle, evaluation and specifying learning, could not be conducted within the six months field research period. These phases are documented in this thesis. The result of this thesis may be very useful for the next cycle of action research where the actual implementation of project will take place after the necessary negotiations and planning have been made. However, this actual project implantation is beyond the scope of this thesis.

8
Analysis of the empirical findings

In this chapter, I analyze of the empirical material presented in chapter 5, chapter 6 and chapter 7. The study revealed that the performance of HIS is not in a satisfactory level in both cases studied and at the central level, although the levels of performance differ from one case to another. To elaborate the situation, I adopt a social-technical perspective of HIS, making an analytical comparison, and relate to the information infrastructure theory (Hanseth and Monteiro 1998). Within this perspective, the role of installed base and inscriptions in the context of HIS development process is carefully analyzed. The study acknowledges the socio-technical complexity of the HIS imposed in the development process, analyzed using Actor Network Theory (ANT), specifically upon the concept of cultivation and participatory approaches in the development process. The chapter is organized as follows. Section 8.1 describes the existing information process in relation to information culture. The problems associated with the existing HIS are described in section 8.2. In section 8.3, I analyze the HIS development process in the information infrastructure perspective. The development process itself is present in section 8.4.

8.1 The information process and information culture

This research revealed that there are considerable efforts on the management and use of health information at the local levels of the HIS in the two cases studied and presented in chapter 5 and chapter 6. However, increased attention is still needed in order for them to become more effective in the use and management of the health information, for the improvement of healthcare activities within their respective areas.

Lippeveld and Sauerborn (2000) describe a HIS to be comprising organized set of interrelated elements, mainly grouped into two entities: the information process, and the health information management structure (see figure 8.1). Through the information process, raw data (inputs) are transformed into information in a ‘usable’ form for management decision-making (outputs) (Lippeveld and Sauerborn, 2000:16). This description shows the relationship between the internal actors of HIS including HIS management structure, but it does not describe the relationship of the HIS and the surrounding environment (external actors). Apart from the health information management, HIS is also affected by several other factors both human and nonhuman, which are deeply embedded in the socio-cultural, economic and political situation of a particular country. Furthermore HIS in most developing countries are also subject to the procedures and conditions of several vertical programmes sponsored by international donors to support specific health services.

All these are reflected in the work practices and work environment that surround the processes of data collection, storage, processing and analysis, data transmission and information use; particularly at the local levels of the HIS.

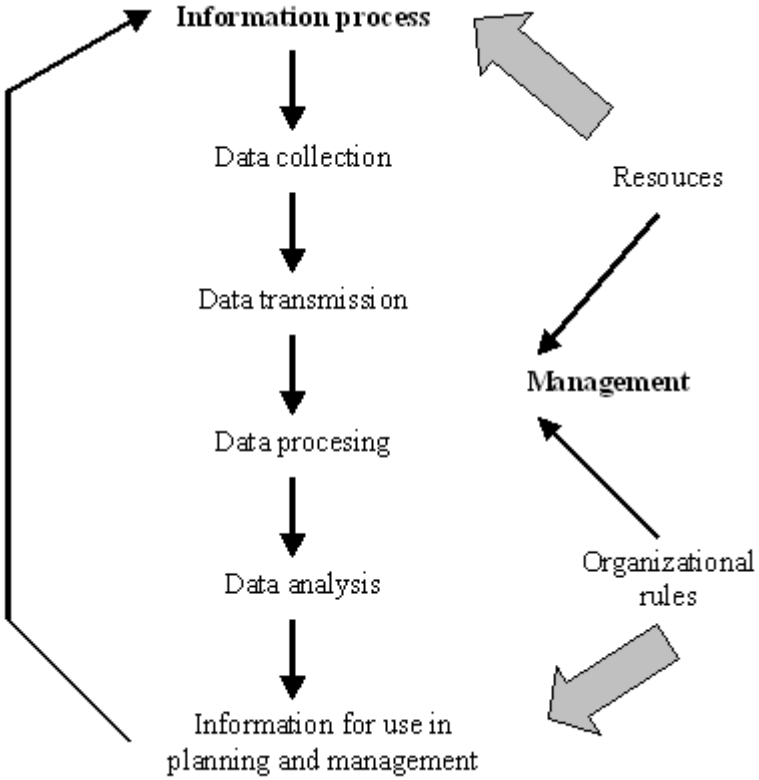


Figure 8.1: Components of HIS. Adapted from Lippeveld and Sauerborn (2000).

The culture of the people regarding how they value the information, also influences the way HIS operates. Many studies report poor information culture of the health staff and health managers. In Zambia for example, the HIS pipeline was built and put into implementation nationwide since 1999 but the challenge remained for using the information generated (Simwanza and Church 2001). In Malawi, Chaulagai *et al.* (2001) state "the main problem in the current health information system is not a lack of information, but insufficient use of available information" (Chaulagai *et al.* 2001:117). In Cambodia despite the functioning of HIS launched in 2001 there is "lack of data culture and limited use of information, especially at provincial level and district level" (Khemrary 2001:96). Other countries such as Tanzania (Rubona 2001) and Bhutan (Wilson *et al.* 2001b) face the same problem as a part of the generally poor HIS. Therefore, we need to create an "information culture" geared towards the use of information for decision-making, by using a participatory and consensus-building process

In contrast to the above examples, in both the cases studied, considerable efforts to improve the information process have been observed, where the people themselves, both at the district and HCF levels are highly engaged in the processes of data collection and analysis, and the use of information. In North 'A' District for example,

the staff at the DHMT agreed to contribute some amount of money, which any one could get whenever they attend any seminar, in order to help support the necessary office operations. For example, they used the money to photocopy some forms that are usually sent in pairs by their respective programmes (EPI and Safe Motherhood) and also to buy fuel for supervision programmes. Therefore, the DHMT has shown an emphasis on the data collection process from the HCFs even if the resources supplied were insufficient. This was not reported in Micheweni District, but it cannot be directly connected to the problem of unawareness of the importance of information. The DHMT is still new (established in October 2003) and therefore cannot have quick alternatives apart from receiving the forms and funds from their ordinary channels. Alternatively, efforts were mainly shown by the HCFs to prepare missing forms manually, in order to report the data to the DHMT as well as having the HCF personal copy at the HCF. The staff at the HCFs also expressed their good will for the data when they bought exercise books, for example to record the OPD data on their own expenses. According to the normal procedures the HCFs are not required to have a copy of the OPD tally sheet (stroke-form), but the staff saw the importance of retaining copies.

The staff both at the HCFs and at DHMTs also showed a considerable effort to strengthen information use, based on their human and material capacity. Traditionally, HIS in most developing countries do not support local decision-making, as they emphasize the data needs of the top managers while ignoring that required by the health staff at the health facilities and the district. However, there is some information which are of direct use for the service providers at the HCFs. For example, growth assessment can be monitored through babies' vaccination cards, or the patients' history can be traced through patients' prescription cards or books. How the information will be used depends on the users; but the nonuse cannot be simply reflected to poor information culture.

The case studies presented in chapter 5 and chapter 6, identified some basic use and also some more advanced use in both cases, though in different degrees. Those differences can be related to varying levels of education, resources availability and staff motivation. Consider the basic information use based on the babies' vaccination cards and patients' prescription cards/books. In both cases, the use of vaccination card was considered important for monitoring the growth of a particular baby. The immediate action taken by the MCH Aide was usually to privately provide health education to a mother whose baby seemed not to grow well. However, the level of the use of the card differed from the two cases, with North 'A' District being better than Micheweni District. This can be related to resources availability and the economic issues. Of the HCFs visited in Micheweni District, two HCFs reported the absence of the cards since January 2004, forcing the clients to buy the cards at TSH 1500, or buy a simple exercise book at TSH 100, which most of the people managed to. The exercise books are used only to record the weight and the vaccination taken, and in order to assess the growth the MCH Aide has to compare it with the big vaccination card displayed on wall. The staff surrounded by many clients, could rarely do this, except when the baby physically showed some nutritional problems.

Many issues influenced the information process and information use, including failure of the government to supply the vaccination cards, and poor people failed to buy the cards instead. People at least managed to buy exercise books, which despite the ability to record the information required, failed to give the visual effects required by the decision makers (MCH Aides). High burden of work, which is a result of few staff working for too many clients, hindered the use of alternative solutions of comparing the data recorded in the books with the big vaccination card displayed on the wall. In contrast, in all three HCFs visited in North 'A' District and at Micheweni Cottage Hospital, this exercise went well due to the availability of the cards.

Prescribers has two options for information access when they need to decide if the cases they were attending should be considered new cases or are re-attendances: either check from the patients' register book or in the patient's prescription book. Information in the prescription book was more easily accessible compared to the other, therefore Prescribers always emphasized the use of the book, thereby asking patients to buy the books at their own expenses when the Ministry failed to supply the prescription cards. This process has now become part of the social system within the community, and if patients failed to buy the books, it is them who suffer.

Apart from the immediate decision-making by care providers, there were also implications at both the HCF level and district level. Personal motivation, educational and professional backgrounds influenced the processes of data interpretation and decision-making, while resources availability and organizational procedures constrained the information process and information use. While all HCFs in both districts managed to prepare the vaccination trends report, just few of them managed to prepare graphs showing the top ten diseases. The vaccination trends report templates are well designed and always available and the MCH Aides have been trained on how to fill the cards. The visual effect of the reports also enables easy interpretation. On the other hand, there is no clear guideline on whether to, and also how to prepare the top ten diseases reports and graphs. The procedures require the data collected at the OPD section to be sent to the district directly without any analysis. Even though the Prescribers decided to have copies of the data at their own expenses, there were also extra expenses to buy stationery to prepare graphs. That is why most of them decided to leave the data on their books only, and incur no other expenses. The problem can further be stated in terms of a financial issue where a programme with enough financial support (EPI) managed to support its information system part compared to the one without money (Statistics Unit).

Talents and professionalism also impacted on the way people value information. At Chaani Masingini PHCU, the Prescriber who by training is a Public Health Officer insisted on the use of information for public health education programmes, and even complained about the gap in the current information system which does not record public health education programmes. At Mkokotoni PHCU, the use of a low level map that showed individual houses in the village during the 2004 diarrhea outbreak

(figure 5.3) was very effective to prevent further possible spread of the disease. This map was prepared by a staff who was previously working at the PHCU but now for the DHMT. The map which was just a one person's initiative, proved to be very helpful to this national issue.

The differences shown in the information-handling and information use between the two DHMTs reflects the influence of institutional capacities in terms of resources and experience. The North 'A' DHMT prepared several reports, which were displayed on walls (see Photo 5.4), while Micheweni DHMT did not. The Micheweni DHMT was less than one year old (during the time of study) hence less experienced, and relied on financial support primarily from the Ministry, which was most of the time unavailable. North 'A' District is a pilot district for many donor-funded projects hence the DHMT used the same resources to cater for some of their information needs. This also has an impact on the HCFs since if the district did not prepare and display graphs, then how could they ask the HCFs to do it.

8.2 Problems facing the health information system

In this section, I analyze the problems associated with the information process, and relate them with the work practices at the local levels of HIS in particular, and to the general healthcare organization in Zanzibar. The problems are interrelated, and are discussed under three topic areas: lack of clear information strategy, Scarcity in human and non-human resources, and the problem of information system design that reflects to the needs of the top levels only without addressing the local levels needs.

8.2.1 Lack of clear information strategy

This is the biggest problem facing the existing HIS in Zanzibar, which while having its roots at the central level, influences the information process through all levels down to the local level. There was no central information center with clear responsibilities within the organization structure of the Ministry of Health leading to the problem of different programme-based information systems. While these programmes have common data sources at the local levels, there is extensive fragmentation at the higher levels, where the information could not be shared between the managers and policy makers of even closely related programmes such as Safe Motherhood and Nutrition.

Another aspect related to information strategy is the absence of guidelines on what, where and how to collect the data. Citing Lippeveld (2000), "Part of data collection instrument design is the production of a set of instructions, explaining to care providers how to fill in the data items in the form" (Lippeveld 2000:107). More generally, the guidelines should be available on the whole information process through data collection, transmission and use. While this was largely unavailable in the old HIS, the designers of the new HIS also did not see it as a major issue. The result of the absence of guidelines was reflected in poor feedback especially from the higher levels, and clear gaps in data collection tools for highly demanded data such

as maternity and mortality. While the Safe Motherhood Programme requested delivery data from hospitals, MCH Aide and TBAs at every clinic, it was not clear on how these data should be collected before they are aggregated into the monthly reports. While there are targets set by the Ministry to reduce infant and maternal mortality rates, there are no guidelines on how the mortality data should be collected and indicators calculated.

8.2.2 Scarcity in human and non-human resources

As the case it is in most developing countries (see for example Lippeveld 2001; Mosse and Sahay 2003), this study revealed a shortage of human and non-human resources; especially finance, in both the cases. The DHMTs rarely received funds to buy stationeries or fuel to supplement the small quantity donated by some programmes. The staff therefore, either had to contribute from their pockets, as the case was in North 'A' DHMT, or rely only on what was available as was the case at Micheweni DHMT. This also had its effect on the availability of forms when there was shortage at the HCFs. IT resources were also a problem with only North 'A' DHMT having a computer. Communication between the DHMTs and staff at the HCFs were mainly through staff's own expenses, except for the two mobile phones given to the North 'A' DHMT.

The case studies indicate that the HCFs were understaffed in terms of both number and qualifications. This in most cases resulted high workload to the staff at the HCFs leading to them sometimes forgetting to fill necessary data, as was the case for nutrition. The DHMT staff had a problem of too many responsibilities. For example, the North 'A' DMO also worked as the In-charge of Kivunge Cottage Hospital and also had to attend patients at the hospital, as a result she always had to work late evenings at her home. The first DMO at Micheweni District who worked up to November 2004, was also the Pemba ZMO and also attended surgery sessions at Wete Hospital. As a result, he was never available to work for the DHMT. The newly appointed DMO was also In-charge of Micheweni Cottage Hospital and at the same time also attended patients at the hospital. The under-qualification and lack of adequate data training was reflected in the way health orderlies collected data compared to the professional staff, where for example, at one HCF a health orderly recorded six injections for one family planning client. This was also reflected on the preparation of the Safe Motherhood reports where staff in all the HCFs visited recorded inconsistent figures (see table 7.1, table 7.2, figure 7.2, figure 7.3 and Appendix C.4).

The problems here are interrelated with the financial issue being at the center, as it influences the availability of both human and other material resources. This arises from the financial incapability of the Ministry of Health. This has its impact to the staff, who are overloaded and also have to spend some money from their pockets to make things carryon.

8.2.3 Information system design reflecting to the needs of the top levels only

Without extra effort, the DHMTs and the staff at the HCFs could hardly use the existing HIS for any management of the clients and patients. This was shown for example, in the OPD data which the Prescribers had to copy the data into small exercise books at their own expense. If the Prescribers did not do this, they could not have copies of the data after they have sent to the DHMT, which in turn is by procedure required to send the data to the Statistics Unit without doing any processing or retaining a copy of the data. Only the EPI Programme supplied templates that can be used to show the immunization performance of every HCF and for the districts. The Safe Motherhood Programme on the other hand, supplied only monthly summary forms which had nothing to do with the management at the HCFs. Information efforts depended on the local initiatives of the staff at the DHMTs and HCFs. These efforts however, were constrained due to the limited financial support, and the top down effects to the design of the data collection tools and indicators, a problem quite wide spread in many developing countries (Lippeveld 2001; Mwaluko and Pazvakavambwa 1996).

8.3 Developing the new HIS: an Information Infrastructure perspective

As argued earlier in chapter 2, an effective HIS needs to take an information infrastructure rather than a traditional HIS perspective. This implies viewing the HIS as a shared resource without any limits in the number of users and application. For example, the HIS should help care providers in service provision, health managers in health management and national policy development, and the international organizations like WHO should be able to use it for the global strategic plans.

The case studies showed that despite the relatively smooth operation of the HIS at the local levels in Zanzibar, the HIS has proved to be a resource for a very small group of people and application at the national level. The use of the information at the local level was also limited, making the cost to benefit ratio of the information collected high. The HIS was very fragmented with mainly two programmes (Safe Motherhood and EPI) receiving some usable data and the Statistics Unit receiving totally fresh and raw data without any pre-processing at any local level. Data collected seemed to be an exclusive property of the programme requesting the data. The ZHMTs never received any routine data; the same was the case with some vertical programmes like the Nutrition, which could easily get necessary data from the Safe Motherhood Programme but never got them. Neither of other programmes or government agencies such as the Office of Chief Government Statistician, that is responsible for all the government data, could easily share the data from these programmes.

To prevent the same problems for the future, the ongoing process of the design of the integrated HMIS should be viewed from an information infrastructure perspective; as a Health Information Infrastructure (HII) rather than a HIS. The integrated HMIS should not be represented only on forms, but should enable data sharing between different actors within and outside the Ministry of Health. To be more precise, it

should be open, evolving, standardized, heterogeneous and a shared resource (Hanseth and Monteiro 1998). The design of the new system should consider the importance of the existing ones and the influence of the installed base (Hanseth and Monteiro 1998). The need to incorporate flexibility into the design process is crucial for the purpose.

8.3.1 The importance of the installed base

A key characteristic of infrastructures is that they evolve over long period where the existing infrastructure, the installed base, strongly influences how it can be improved (Hanseth 2002). Hanseth and Monteiro (1998) emphasize the importance of aligning the installed base with the new for infrastructure to be successful, since new infrastructures are never developed from the scratch.

The existing HIS provides the base for all future development. This includes the existing forms, reports and reporting procedures, the technology, the work procedures in place and organizational rules. These different elements comprises the existing HIS, and are interrelated and mutually influencing each other. All these together with the structure of the Ministry of Health and the related agencies and the organization procedures with which the HIS is installed, forms the heterogeneous network of actors all having different interests, trying to convince each other so as to create an alignment of the other actors' interests with their own (Hanseth and Monteiro 1998). The ultimate goal is to provide health services and their monitoring. How this is achieved represents the need to align interests of different actors, for example how different programmes approach data collection and reporting procedures based on their particular requirements, and the tools and procedures used.

The important thing here is the ability to translate (Monteiro 2000) others' interests into one's own. In the existing HIS not all actors could manage this, showing a clear distinction between the strong and weak actors. For example, related on how the Nutrition Unit failed to receive the data they need despite supplying the tick sheet to the HCFs. The unit did not manage to smoothen the flow of the data through their channel and instead the data was channeled into the Safe Motherhood Programme. Another examples relate to the ZHMTs, which never received routine data, or the Statistics Unit, which could hardly manage to process and interpret the data they received. This ability for translation cannot be simply related to one's interests, and need to be placed within a socio-cultural, economic and organizational context.

How strong the installed base is, influences the way the infrastructure will be developed and deployed. The stronger the installed base the more complex the development process. Despite the less coverage of the existing HIS, the present installed base proved to be strong enough to either enable or constrain the future development. This was evidenced, for example, how programmes like EPI and Safe Motherhood managed to smoothen their data collection and information flow for their programmes. In addition to this the rules and procedures constituting and governing the way people work and services are provided, and the general

organization structure of the Ministry of Health contribute to the strength of the installed base.

8.3.2 Artifacts and inscriptions

To which extent it is possible to reduce the distance between technology and work practice and hence to develop a more usable and sustainable solution depends on how strong the inscriptions are that the actors have. “The concept of inscription refers to the way technical artifacts embody pattern of use” (Hanseth and Monteiro 1998:97). By technical artifacts here I refer to the paper forms, which are the main constituting component of the existing HIS. On the other hand the DHIS software can also be considered as a technical artifact inscribing the assumptions made by its designers.

The paper system currently being used constitutes a relatively flexible infrastructure to support the various work practices. For instance, both the HCFs and the DHMTs use the same form to create their respective monthly reports for each programme. While this can be seen as bad design, this flexibility is desirable for the smooth operation of the HIS especially when it comes to the issue of scarcity of the paper resources. I can argue here that probably the designers of the forms long ago saw the probability of this scarcity and hence designed only one template for each program.

However, this flexibility is limited only to some part of the infrastructure. This was revealed in the process of developing a new HIS and on the attempt to automate the new HIS. The existing paper forms not only were used as tool to collect data and facilitate reporting procedure, but also inscribed the ideas on the way services are to be provided and how can these be reflected in the data collection process. For example, the division of age in the vaccination form reflect the necessity to provide services in those groups, that are children between zero and 12 months and children between one year and five years for children vaccination; and grouping of women into two groups of those within the reproductive age (WRA) and the pregnant women. Another example is the age and sex categorization for the outpatient services shown in the OPD tally sheets (stroke-forms). While it can be simply considered unnecessary, the Prescribers always emphasized the importance of these categories.

The flexibility to change the information infrastructure depends on how strong the inscriptions are within the existing infrastructure. That is, how strong the existing paper system symbolizes patterns of use. For example, related to the re-designing the EPI forms it was very simple to eliminate the categories in the vaccination report for both children and women vaccinations. The motive behind this was that EPI Programme no longer considered the importance of collecting vaccination data for children above one year since most children are now vaccinated in their infant stage. This also shows the importance of varying strength of inscription over time, that is, inscriptions are not necessarily be in the same state all the time.

On the other hand, the process to change the existing OPD tally sheet (stroke-form) was rather difficult. One of the principles that governed the development process was to design tools that will collect minimum essential datasets. However, this could not be achieved in this form. The form strongly inscribed a 'theoretical' data requirements of the Prescribers and other OPD practitioners. For example, it insisted in the sex category while only the inpatient section treats the patients separately, or the age categories where only the hospitals have separate clinics for children and adults but not different clinics for different groups of adults. On the other hand, the categories were considered important for monitoring vulnerability to diseases for different groups something that was never practiced. The result of the design of the new OPD form was that the categories remained there almost more than it was before, but the age groups categorized differently still inscribing the ideas of those who participated in the design process, this time physicians. My discussion here is not whether these categories were important, rather it is how those who considered these categories managed to inscribe their ideas on the forms that are used and how this was complex to change.

8.4 Cultivating the installed base

The cultivation process involved three major steps: moving from the old existing HIS to the new integrated HMIS, aligning the DHIS software to provide a suitable IT solution to the newly designed HIS, and the organizational transformation to align with the introduced new technology. Shifting from the old to the new system involved the improvement and extension of the old installed base to form a new and possibly a stronger installed base, since the new system was aimed to have wider coverage and more disciplined compared to the old. The introduction of the DHIS software to the new system meant to run the installed base further ahead. In both stages, the process of development involved the introduction of new actors to the installed base, that is, the introduction of new artifacts, users and new procedures. The new actors introduced as well as the actors constituting the installed base, inscribed behaviors that represents their interests and the interests of those actors who have close ties to them. Therefore, the design process requires a close analysis of the way those behaviors are inscribed, that is, a natural process of interfering with the socio-technical network of all those different actors and their interests.

An interesting point is that once infrastructures are developed they are self-reinforced and uncontrollable; can just be influenced (Hanseth 2002). What is important then, is how we develop the infrastructures to be flexible enough to prevent lock-ins once the infrastructure gain momentum. Of the three generic strategies for changing infrastructure described by Hanseth and Monteiro (1998), an evolutionary model seemed to be appropriate for the development process. The process involved several negotiation involving different stakeholders and still many to come. In this situation prototyping, evolutionary development, learning and user involvement is emphasized (Hanseth and Monteiro 1998). The cultivation approach I adopted, is also emphasized in HISP approach to infrastructure development as Braa and Hedberg (2002) explain:

> By cultivation, we mean a slow, incremental, bottom-up process of aligning actors by enabling translation of their interests and gradually transforming social structures and information infrastructures where the resources already available form the base. The precise outcome of the design process is not given, but is negotiated within a broader set of goals.
>
> (Braa and Hedberg 2002:116)

8.4.1 Changing the paper system

The analysis in this subsection involves the changing from the old HIS to the new integrated HMIS. The main focus of the design was to have an integrated HMIS where different programmes could share the data. In these different programmes there are different kind of users, from service providers at the HCFs to top managers at different programmes and the policy makers. The idea of having all these data at the Statistics Unit as the data pool implies enhancing the sharing capability between the different users.

The availability of the software to be used for the new HIS during the time of the revision process of the new HIS forms had its impact on the design process. For example, the researcher's attempt to use the concept of the minimum essential datasets especially in the OPD data. This concept is one of the HISP traditions, and is inscribed in the DHIS software itself. On the other hand the inscriptions on the original OPD form (stroke-form) were strong enough not to allow changes to the way the form collects data. This therefore, raised the need to respect the installed base for the change process. Heeks (1999) emphasizes on minimizing, or if possible to eliminate the gaps related to the change process. Applying these concepts, the new form had almost the same layout as the original form, with the changes reflecting the needs of the same people and not of the idea of the minimum essential datasets presented by the HISP researcher.

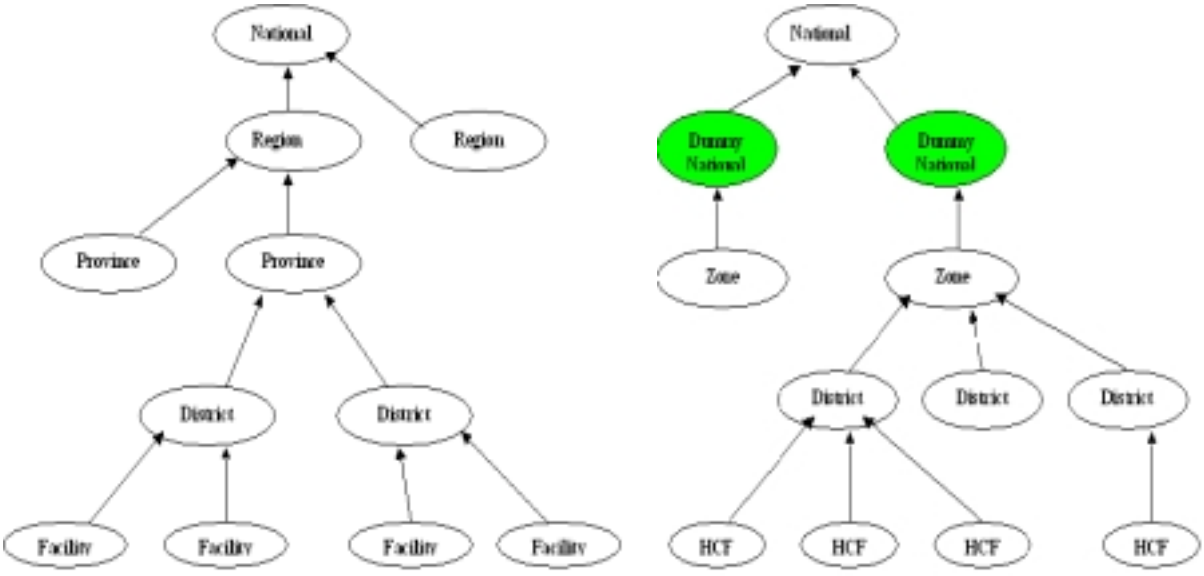
Another important example from the same form, even though it does not have effects on the number of data elements, was about whether to use tallies or ticks on the new OPD tally sheet. On the design of the new forms, the new OPD form was aimed to use ticks. However, during the revision process it was realized the importance of using the same tallies as it is in the original stroke-form. Practically, this will reduce the gap on the layout of the new form from the old. The idea of using ticks was only aimed to create uniformity from the other forms such as EPI and Safe Motherhood forms and hence was not strong enough to compete with the inscribed behaviors representing the way Prescribers are used to for a long period.

8.4.2 DHIS adaptation

An interesting point about the DHIS software is that the software was originally developed in South Africa for the South African healthcare organization and context. The functional requirements of the software are therefore based on the South African context and hence inscribing the behaviours of the South African healthcare organization structures including organization hierarchies and procedures. How flexible the DHIS software is, is an important factor for its adaptation to the Zanzibar

healthcare system and context; the stronger the South African inscriptions the more difficult it can be adapted to the Zanzibar context. One advantage is the existence of some similarities between the two contexts. These include the reporting nodes and reporting frequencies and the official language used in the HIS. In Zanzibar both English and Swahili languages are used officially and the fact that all the paper forms are in English encouraged the use of English language in the DHIS software, as it is in South Africa.

However, more important for this discussion are the differences between the two contexts and how they have been dealt with. The DHIS software is currently locked to the organizational structure of the South African organizational hierarchy consisting of five levels: national, region, provincial, district and facility. In contrast Zanzibar has four levels: national, zonal, district and facility (HCF). To solve this problem a 'dummy' national level was introduced, see figure 8.2. Note that there are only two zones in Zanzibar; therefore introducing a 'dummy' level above the zones seemed to be more appropriate for the implementation. This shows a certain level of flexibility for the DHIS software for an organization hierarchy, which have less levels than South Africa, but this flexibility cannot be guaranteed in the opposite way.



South Africa (origin) Zanzibar (adaptation)

Figure 8.2: Organizational hierarchies of the healthcare organizations in South Africa and Zanzibar and how they have been implemented in the DHIS software.

Another important discussion is about how the software could be used to capture the OPD data. This process expressed how strong the inscriptions in the OPD form are. The data entry screen of the DHIS software organizes records in rows. This arrangement favours the inscribed idea of minimum essential datasets. However, the paper OPD form categorises each diseases into age, sex, and case type, resulting into a higher number of data elements. The data entry screen that organizes data in rows could therefore not be suitable solution for a long list data derived from this form. Heeks (1999) suggests the minimum changes for successful development, arguing

that the smaller the change the higher the probability for success (Heeks 1999). These small changes are meant to respect the installed base. Reflecting to this, an idea to develop a different application that will take care of that particular form was agreed. This in some sense could be considered as a gateway between the paper and the DHIS database. This application, which is not yet developed is meant only to capture data and store into the DHIS database and leave all the analysis be managed in the DHIS application layer and its ally, Microsoft Excel pivot tables. This expresses further development of the infrastructure where another application will be able to join the existing infrastructure.

While the idea to develop a different application is very applicable for the flexibility of how the OPD data from the new form can be dealt with, the challenge remains on how to avoid lock-ins in the database for the OPD data in the future. For example, a change on the age groups in the OPD form would result on the future changes to be incompatible with the previous categories and hence making the old data hardly analyzable using the new system.

8.4.3 Organization transformation

In this subsection, I analyze the process of organizational transformation as a result of introducing new technology to the organization. Drawing upon an information infrastructure theory, the development process involves the alignment of the new into the old. But the old is usually part of an organization structure implying that the process interferes with the existing organization structure.

The research revealed some changes associated with the introduction of the DHIS software to the Zanzibar healthcare system. Since the DHIS software is a technological solution, it means that there are some general requirements that must be fulfilled in addition to the specific inscribed behaviors of the software, as it has been discussed in the previous sections. To align the two, that is, the technology and the organization, a consensus must be reached on how to minimize or if possible, to eliminate the gaps between the conceptions related to the technology design and the reality of the working environment of which the technology will be deployed (Heeks 1999). This is a mutual process requiring flexibility of both the technology and the organization. How flexible the organization is, depends on the socio-cultural, economic, political and organizational settings of the organization. For example, poor economic situation can make an organization inflexible when it comes to the issue of purchasing hardware and supporting software.

Heeks (1999) suggests one way to reduce the gaps, if they exist, by changing organization such as by providing training on the new system and securing necessary fund to support the change process. Training, building and institutionalizing data and information culture is also emphasized in the HISP approach for aligning the installed base (Braa and Hedberg 2002). Based on the empirical material presented in chapter 7, the analysis made here concerns only to

the pre-implementation stage, since the software was not yet implemented during the period of this research.

Reflecting to the requirements of the introduced new technology, several aspects that affect the process were identified in advance. These were the results of the joint-consultancy conducted, where the consultants proposed the Roadmap (see Appendix D.1) that outlined the way forward on the general HIS implementation including the computerization process. Issues that could inhibit the adoption process were identified and the alternative solutions were suggested. The possible constraints identified include the working paper system, the hardware and software capability, and human and organizational capacity for the adoption of the software. The proposed solutions to combat these constraints include the re-initiation of the new HIS forms including its training and resources allocation, budget allocation of the new HIS that also covers DHIS deployment including hardware acquisition, and plan to secure IT technical support and special IT training for the purpose of deploying the DHIS software.

8.4.4 User participation

Successful development of the information infrastructure requires involvement of the users of the system, as they are very important actors in the design and deployment process. Drawing from actor network theory, Hanseth and Monteiro (1998) describe users as designers since they influence the way the technology is deployed. When the developers are close to the users and consult with or involve them in the construction and trial stages, the network into which the intended user behavior is inscribed will be stronger and accordingly harder for the users not to follow this (Hanseth and Monteiro 1998). User participation specifically helps to reduce the gaps along the objectives and values dimension, where different hard, rational worldviews from different stakeholders can be compromised (Heeks 1999).

How users should be involved also depends on the context. With some recent research on user participation in developing countries, I draw upon Puri *et al.* (2004) explaining the contextuality in the process of information system design in three developing countries; where in South Africa, culture and tradition of the community influenced the way users were motivated to participation. In Mozambique the approach emphasized the role of mediating agency (academia) in facilitating bridging the gap between the top and the bottom, while in India the participation mainly recognized the Indian hierarchical settings (Puri *et al.* 2004).

In the Zanzibar context, both hierarchies and mediating agency motivated the user participation on the HIS development process before and during this research. The top-down hierarchical setting together with donor influence, influenced the design process. The design process started by negotiating with the top managers of different vertical programmes where the first prototype of the HIS forms was discussed, before the designers discussed with the lower level operational managers. Researchers played important role as mediating agency. This is reflected in the

presentations made in the stakeholders' workshop. The reports and presentations were prepared based on the interviews with the staff at the HCFs. This implies that the researchers helped to bring the opinions of the staff at the HCFs to the top managers within the Ministry of Health, that is, bridging the gap between the two. The decision to prototype the new form in three districts implies that staff at the HCFs will have a chance to participate in the development process. However, the challenge remains how capable the practitioners are on the real participation.

9
Discussion and conclusion

In this chapter, I present the analytical discussion towards the research problem addressed in the thesis. The discussion presented is meant to respond to the main research questions in order to offer solutions to the stated problems as well as to contribute knowledge in the relevant domains. The chapter is organized as follows. Section 9.1 presents the analytical discussion of the research problem and recommendations. Section 9.2 presents the research contributions, organized in three subsections. Subsection 9.2.1 presents the theoretical contributions, subsection 9.2.2 presents methodological contributions and subsection 9.2.3 presents the practical contributions of the research. Finally in section 9.3, I outline further study areas in connection to this research.

9.1 Problem discussion and recommendations

This research informs study and change, that is, studying the existing HIS, identifying problems related to it and proposing and implementing solutions for the purpose of improving it. The research focused on the study of the HIS at the local levels of the healthcare system, aiming at exploring the procedures and tools used to collect and store routine data, identifying problems related to the current HIS and to inform 'prototyping' DHIS software for its adaptation to Zanzibar's healthcare system and context, as an alternative solution to the paper-based system.

In assessing the existing HIS, two cases were studied from two different districts, one from each of the Islands. Qualitative research methods were used including ethnographic interviews, observations in the health facilities and document analysis. The openness of the qualitative research methods, mainly interviews and observations, helped me in adjusting my interview questions and observation guide to what was perceived to be relevant, following an exploratory approach. A combination and comparison between what people said, what I observed and what was recorded in the documents can be used as evidence for understanding the larger culture and social context in which the particular society in study belongs. Regarding the introduction of the DHIS software, a participatory action research approach was employed.

Generally, the study responds to the need for HIS reform, particularly in developing countries. The research revealed problems associated with the existing HIS, which are common in developing countries. Challenges and opportunities on HIS development and IT deployment for the public healthcare sector, identified in this study, are also applicable in the general context of developing countries. The

problems, challenges, opportunities and recommendations are discussed under the following three research questions.

How can management and use of information be improved at local levels of the health information system?

The research revealed that there are considerable efforts involved in the management and use of health information at the local levels of the HIS in both of the cases studied. However, these efforts were limited due to limited support from the higher levels. Therefore, increased attention is still needed in order for the health workers and managers at the local levels to become more effective in the management and use of the health information, for the improvement of healthcare activities within their respective areas. Complete reform of the HIS, that is, transforming the existing HIS into a tool that fully supports management functions, particularly at the local levels, is a time-consuming and complex process. This research, as well as the literature in the domain, acknowledges this.

In this study, problems that inhibit the operation of the existing HIS have been identified in three main areas. First, there is a lack of clear information strategy in the Ministry of Health which resulted in fragmentation of the HIS at the higher levels, and an absence of guidelines on what, where and how to collect important data. Second, there is scarcity in human and non-human resources including finances. The third problem area concerns HIS design that reflects only the needs of the top levels of the national healthcare system without addressing the needs at the local levels. The problems are interrelated and can be explained in terms of the socio-cultural, economic, political and organizational structures that shape the healthcare sector. This implies that changing the existing HIS needs to tackle the problems identified by carefully considering the context of which the HIS operates.

HIS in most developing countries are operated in a top-down manner (Lippeveld 2001; Mwaluko and Pazvakavambwa 1996), shaping the healthcare sector itself. The healthcare sector in most developing countries is in the process of reform aiming at decentralization including decentralization of HIS management. However, the context does not favour the process, since in most cases the process could not be supported in most of the essential aspects such as finances and human and institutional capacity-building. As a result in most cases the decentralization is only partial, if done. Therefore, to improve the management and use of the information at the local levels, first requires improving the same at the central level. In the case of Zanzibar, as presented in this study, the decision to deploy the integrated HMIS can be considered as a starting point. What is important is how this process is supported in terms of financial, human and institutional capacity, both at the central and local levels. The institution shall ensure adequate qualified staff in terms of both medical training and knowledge of statistics, thereby conducting necessary training when needed. Special training for health staff on data analysis and how to relate data with the problem-solving at their respective places should be emphasised. The data collection and storage tools should be available all the times, and supplied and collected on time. Effective supervision, feedback and motivation must be given to

the local level health workers who are the main data collectors. The higher levels should encourage comments from the lower level staff on how to improve the data collection process and more generally the whole information process, and they should also involve them in HIS development activity. Once this is in a good state, the next step is the computerization of the HIS in order to improve the attained stage, thereby improving the efficiency of the work process.

To what extent may the use of the software system, District Health Information Software (DHIS), improve efficiency and effectiveness in the processes of data analysis, that is, providing means for analysing data and producing higher quality information in more cost-effective ways?

IT has a role to play in improving the health information system. However, IT is only a supporting technology and therefore the quality of information generated as a result of deploying IT solution also depends on the data collected by a particular HIS. The DHIS software, as an IT solution, is no exception. On deploying the DHIS software, there are assumptions made regarding how the software can be used to improve the information process of a particular HIS. The HISP spirit is that the DHIS software should be able to be used under minimum hardware and software requirements, reflecting the capabilities of most healthcare organizations in developing countries. HISP also emphasizes local level analysis and use of the data. This is reflected in the software itself, which requires the data entry at local level (health district level). The use of tools such as Microsoft Excel for data analysis also encourages easier data analysis where the users can use tools with which they are experienced. The back-up system used employs a light files technique where the simplest external storage device – the diskette -- can be used. The reporting system uses the same technique where a diskette or Internet can be used to report from lower level to higher level. However, these advantages can result in benefits only if the software can be successfully installed and used.

In this research, I aimed to install and configure the DHIS software at the health district offices, develop some customized reports, conduct user training and work with the users on populating the database with health data. However, when I entered the field site and saw the real situation, I changed this aim and instead I aimed at garnering political power; that is, acquiring not only permission but also to ensure the necessary facilities for the implementation process including technical and financial support. The DHIS software can only be installed and used if the necessary hardware and supporting software are available and can be sustained. The software can be flexibly used and maintained only with skills and an established data culture, and by ensuring that the paper-based system to be computerized is functioning properly.

Therefore, researchers and developers should see the process of garnering political support as an important strategy when attempting to introduce IT solutions to organizations, particularly healthcare organizations in developing countries. This is because the healthcare sector in developing countries is influenced by several factors

including the influence of outside donor agencies. When introducing an IT solution, a focus must also be made on routines, training and organizational changes that would enable local initiatives based on the data collected and information usage. More generally, it is important to build an organization where action based on data is initiated at all levels, without only responding to orders from the higher levels. Both financial and technical support must be ensured. The technical support shall incorporate the staff of the organization thereby improving the technical capability in cross disciplines, that is, for management and use of computer hardware, software, and statistics as well as the general healthcare skills.

How can knowledge obtained from organizational change experience in Zanzibar be used when introducing IT solutions to public healthcare organizations in other developing countries contexts?

HIS developers in developing countries, as well as the managers of the healthcare organizations should consider the process of introducing IT solutions as a staged process to be managed. This study suggests the need to consider the organizational context when introducing new technologies to an organization, rather than only the technical aspects. This is because the process is more complex than many practitioners have realized. The issue becomes more complex in the context of developing countries due to the present social, economic, political and organizational settings.

Introducing new IT solutions is not only about installing the hardware, software and offering necessary training, but involves a wider process of organizational changes and political brokering. The need to identify issues in advance that may facilitate or inhibit changes is crucial for the task, and a plan must be made on how to reduce the gap between the technology requirements and the reality. These may include identifying the existing staff capabilities in terms of quantity and quality in relation to the requirements of the new technology, identifying and securing financial support, identifying areas and structures of the organization that are going to be affected and suggesting possible solution in order to align the organization in the right direction responding to the new technology that is to be introduced. All of these can be reached through a participatory approach where both the developers and the problem owners, that is, members of the organization, participate in the process. A need to negotiate with all necessary stakeholders within the healthcare organization together with its partners is very important, considering the diverse nature of the healthcare organization.

9.2 Research contribution

This research contributes to the existing knowledge in three dimensions: theoretical, methodological and practical.

9.2.1 Theoretical contributions

Through the analysis and discussion of the empirical findings, this thesis contributes to the domain of health information systems in developing countries. The discussion above presented some problems associated with the HIS in Zanzibar, and offers suggestions on how to solve them. The problems include: (1) a lack of clear information strategy resulting into fragmentation of the HIS especially at the higher levels and the absence of clear guidelines; (2) scarcity in human and non-human resources including finances; and (3) problems in HIS design that reflect only the needs of the top levels of the national health system without addressing local level needs. Several authors report the same problems in developing countries. Lippeveld (2001) and Mwaluko and Pazvakavambwa (1996) report the centralized HIS design and management. The problem of fragmentation is reported in Lippeveld (2001) and Lungo (2003) who reports the problem in Mozambique and Tanzania Mainland. Lippeveld (2001) reports the problem of inadequate human, physical and financial resources. Specifically, Mosse and Sahay (2003) and Mukama (2003) point to the problem of human resources in Mozambique and Tanzania Mainland, respectively. This thesis also relates the stated problems with the existing social, economic, political and organizational structures that shape the healthcare sector in developing countries.

Local initiatives made by the staff at the local levels, expressed their personal motivations towards the information process, despite the constraints imposed on them resulting from the already stated problems. For example, in North 'A' district, the staff at DHMT contributed some money to help the office operation including supply of stationeries. In all of the HCFs visited, the Prescribers bought books to record the OPD data in order to have copies of the data that are sent to the district. Even if most of the HCFs did not use these data, their intention to keep the data at their own costs showed how much they valued the data they collected. This is in contrast to much of the literature, which reports a complete absence of information culture (see for example, Sapirie 2001; Simwanza and Church 2001; Chaulagai *et al.* 2001; Rubona 2001; Khemrary 2002; Wilson *et al.* 2001b, Mursalin and Haque 2001).

To combat the problem of fragmentation, there is a need for an integrated HIS that will produce data for each individual programme at each level, and also act as a central data pool, where all necessary stakeholders within and outside the healthcare sector can share the data. My analysis of HIS in the view of information infrastructure basically starts at this point, and extends through the heterogeneous nature of HIS and the need for evolution due to the changing needs of several stakeholders. In a narrow view, HIS can be considered as a tool to support a small society within the healthcare sector. However, analysing more carefully we could judge that the healthcare sector does not represent a closed society, in the sense that it is an integral part of the development programmes of a particular society. Hence the same will be the case for HIS even though not all information will be shared by everyone. Therefore, an ideal HIS should be open to the number of users and applications. That is, different stakeholders within the healthcare organizations

should be able to access the HIS according to their requirements and technical capability.

Viewing the HIS development process from the information infrastructure perspective, gives a clearer insight of the real situation of the design process, thereby looking backward by considering the importance of the installed base while looking forward on how to prevent possible lock-ins when the system starts to be deployed and attracts more users. The development of a HIS that integrates all the programme-based HIS within the healthcare sector, and the process of automating the new HIS is likely to face the latter situation, if not carefully managed. The use of information infrastructure theory has therefore helped to better analyse the HIS development process.

Most literature discussing information infrastructure (for example, Hanseth and Monteiro 1998; and Hanseth 2002) discusses systems shared by the global community such as Internet, EDI networks and business sector infrastructure such as electronic commerce and telemedicine networks, and corporate infrastructures that constitute a web of integrated information systems such as ERP. HIS are not as complex as such global systems like Internet. However, the focus on integrating several programme-based information systems into a single system draws our attention to conceptualizing the process in the information infrastructure perspective, since in reality these systems are not totally discarded but are rather integrated under the HIS umbrella. Furthermore the healthcare sector attracts more applications such as GIS, and all these need to be integrated into the information system. How these can be integrated depends on how the host HIS was designed.

In recent studies that propose the use of information infrastructure theory in the HIS research, Skobba (2003) analyzes the process of deploying DHIS software in the Mozambican health information system, and Boulus (2004) analyses the process of implementing an Electronic Patient Record (EPR) at Rikshospitalet, the national hospital in Norway. Skobba (2003) describes the complexity related to the deployment of the DHIS software where he explains the tension that arises when shifting from the old legacy systems that are part of the installed base to the new system. In her study, Boulus (2004) describes the socio-technical aspects of the complexities and challenges emerging from the implementation of the EPR, and in particular how to manage a gradual transition to digital patient records. She uses the information infrastructure theory to show the importance of the heritage of the installed base as well as the need for strategies to manage gradual transitions, such as cultivating the installed base and developing gateways that can link various components. The two studies used the information infrastructure theory to analyse the process of implementing IT solutions for the healthcare sector. In this thesis I am arguing the usefulness of the theory not only in the process of developing IT solutions but also in the design of the paper system, since the computerization process is the next step after the paperwork is done. In the light of Actor-network theory, the change process acknowledged the importance of the inscriptions in the paper artefacts that are part of the installed base, and how they affected the design of

the new HIS forms, for example, how the layout of the old OPD tally sheet (stroke-form) influenced the design of the new OPD tally sheet.

The use of actor-network theory helped to unpack the socio-technical complexity related to the change process, that is, the process of infrastructure development. ANT views the technology as an actor along with other actors and focuses on the relations and interplay between the different actors (Monteiro 2000). However, some of the actors within the actor-network appear much 'bigger' and more powerful than others, though each has limited influence (Hanseth 2002). For example, a user organization can have more influence than individual users within the organization, and is also subject to much tension from other actors. This turned the focus on the need to explicitly study the relationship between the technology and the organization, as a result of introducing new technology. While the ANT helped on unpacking the socio-technical complexity related to the design process, viewing the process from the socio-technical perspective helped to identify important aspects to be considered by the organization in order to align with the change to be introduced The theory was very useful for identifying issues in advance, that may facilitate or inhibit changes in order to plan how to reduce the gap between the technology requirements and the real situation within the organization. The issues identified include identifying the existing staff capabilities in terms of quantity and quality in relation to the requirements of the new technology, identifying and securing financial support, identifying areas and structures of the organization that are going to be affected, and suggesting possible solutions in order to align the organization in the right direction to respond to the new technology that will be introduced.

9.2.2 Methodological contribution

This research informs study and change, that is, studying the existing HIS, identifying problems related to it, and proposing and implementing solutions for the purpose of improving it. A participatory action research approach was used regarding the introduction of DHIS software as an alternative solution to improve the functioning of the existing HIS. My research plan proposed a five-phases research cycle described by Baskerville (1999), where in the action-taking phase, I planned to do software installation and configuration, training and development of customized reports. However, my plan was seriously changed based on the plans and the real situation of the HIS at the Ministry of Health. Instead, I mainly concentrated on the process of garnering political acceptance for the software introduction rather than being able to follow my original plan. This insists on the need for flexibility in the action research design, particularly participatory action research where the practitioners are not only the problem owners but also have a role as co-researchers. Baskerville (1999) describes the action research collaborative framework as one of the problems of action research, stating that it may diminish the researcher's ability to control the process and the outcomes of the research (Baskerville 1999). In contrast to him, I am arguing for the usefulness of participatory action research in HIS development that, if the intention is to bring about changes as the case was in this research, the need to consider the target organization is crucial for the task. My

intention to work through the political brokering for the process of introducing DHIS software before deploying the software was meant to set necessary conditions and a conducive environment for the implementation of the software.

9.2.3 Practical contributions

My practical contributions are to the client organization, that is, the Ministry of Health Zanzibar and also to the HISP programme. Through the HIS development process, I participated in all negotiations with the Ministry's officials at different levels. The result of this is that the Ministry agreed to use the DHIS software as the Ministry standard in order to support the ongoing HIS reform process. In this process, I acknowledge the importance of a 'gatekeeper' who helped to open the doors of all the necessary stakeholders in the negotiation process. Following the acceptance of the Ministry, I contributed to the following. I participated in the preparation of the Roadmap for HMIS implementation, the revision of the new integrated HMIS forms and the creation of the DHIS database for North 'A' District. The Roadmap is the basis for the next cycle of action research; however it is beyond this thesis. To the HISP programme, the research helped to create a basis for the extension of the HISP work in Tanzania from the mainland to Zanzibar.

9.3 Further research

Related to this research, it could be interesting to study how the DHIS software will be deployed and institutionalised after the necessary negotiations have been made.

This research revealed some gaps in data collection tools, especially for data related to delivery and deaths. While almost all delivery data are not properly traced out, only deaths that occurred in hospital are recorded. The maternity system in Zanzibar constitutes more TBAs than the hospital maternity system. This problem has been discussed in relation to the design of the new integrated HMIS. However, a feasible solution could not yet be suggested. Therefore, further research is needed on how to take care of all these data within the PHC framework in a cost-effective way. A need for participation of the other government agencies dealing with these data and the community itself is crucial. Only then, the crucial indicators such as the Maternal Mortality Rate (MMR) and Infant Mortality Rate (IMR) could be properly calculated.

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Appendices

Appendix A: Ethical clearance

Appendix A.1: Letter of introduction to the Ministry of Health from the University of Oslo.

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FACULTY OF MATHEMATICS
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Our ref:
Your ref:

Oslo, 12 June, 2004

To Whom It May Concern:

Yahya Hamad Shehe is a Masters student in Informatics at the University of Oslo.

The HISP (Health Information Systems Program) in Tanzania is based at the University of Dar es salaam and is conducting research and development in health information systems in collaboration with the Ministry of Health, Tanzania, and the University of Oslo, Norway. In the Dar es Salaam Health Region (3 districts) and in Kibaha and Bagamoyo districts, HISP has already developed a database application for the routine health data reports (the reports in MTUHA) and a training program is being implemented.

Internationally the research and development in HISP is carried out in collaboration with Ministries of Health and Universities in South Africa, Mozambique, Malawi, Tanzania, Ethiopia and India. A free and open source district based health information software is developed by this "South-South" network which is implemented and in country wide routine use in South Africa, Malawi and the state of Andhra Pradesh in India. The software is in the process of being adapted and implemented in Mozambique and Ethiopia. HISP is funded by NORAD.

UNIVERSITETET I OSLO
Institutt for informatikk

A Masters program in Informatics and Public Health is part of this HISP network. This program is starting at UDSM in 2005. Yahya Hamad Shehe is doing his Masters research within HISP and as part of the HISP masters program. He would like to present and demonstrate the software for the Ministry of Health and Social Welfare, Zanzibar. He would also like to adapt and test the system in two districts and in the head quarter. More generally we would like to extend the research and development in HISP to Zanzibar.

We therefore kindly ask you to give him permission and support so that he can carry research within the Zanzibar health information system.

Yours sincerely

Jørn Braa
Associate Professor

Appendix A.2: Letter of permission from the Ministry of Health Zanzibar

... 21/6/2004

C.C 106/1

Daktari Dhamana
Kanda ya Unguja
UNGUJA

KUH: KUFANYA UTAFITI JUU YA MFUMO WA HABARI ZA AFYA NDUGU YAHYA H. SHEHE

Husika na maelezo hapo juu.

Mtajwa hapo juu ni mfanyakazi wa Serikali kwa muda huu ni mwanafunzi Chuo Kikuu cha Oslo, Norway, inafanya shahada ya pili (Master in Information System).

Anatarajiwa kufanya utafiti kwenye ofisi za Makao Makuu Kanda na Wilaya, pia katika Vituo vya Afya na hospitali za Wilaya katika Wilaya ya Kaskazini 'A' Unguja.

Naomba mashirikiano yako atakapofika katika maeneo yako.

Ahsante,

JUMA R. JUMA

JUMA R. JUMA
K/KATIBU MKUU
WIZARA YA AFYA/USTAWI WA JAMII
ZANZIBAR

Nakala kwa: Katibu Mkuu
Wizara ya Nchi, Afisi ya Rais
Katiba na Utawala Bora

Appendix A.3: Research permit from the Office of the Chief Government Statistician Zanzibar.

ZANZIBAR GOVERNMENT

SECRETARY
ZANZIBAR RESEARCH COMMITTEE
P. O Box 239
Tel: 2230806
FAX: 2233788

RESEARCH/FILMING PERMIT
(This Permit is only Applicable in Zanzibar for a duration specified)

PERMIT No.ZRP/98

SECTION

Name:	**Bw. Yahya Hamad Shehe**
Date and Place of Birth	19.11.77
Nationality:	Tanzania
Passport Number:	AD302647
Date and Place of Issue:	11/3/02
Date of arrival in Zanzibar:	-
Duration of stay:	-
Expected date of Departure:	-
Research Tittle:	Improving Routine Health Management At Health Districts In Zanzibar: An Action Research Study
Full address of Sponsor:	**University Of Oslo, Norway**

SECTION C:

This is to endorse that I have received and duly considered applicant's request I am satisfied with the descriptions out lined above.

Name of the authorizing officer: **Mohammed Hafidh**
Signature and seal:
Institution: Office Of Government Statistician
Address: P. O Box 874 – Zanzibar
Date: 13/07/04

(For rules and conditions see overleaf)

RULES AND CONDITIONS

I. **You are required to submit Progress Report.**
II. **Not to engage in Political activities.**
III. **Adherence to research topic(s).**
IV. **No permit in restricted areas.**
V. **After completion, three copies of research should be submitted to authorizing Institution.**

Appendix A.4: Research permit from the Zanzibar Medical Research Board

SERIKALI YA MAPINDUZI YA ZANZIBAR
WIZARA YA NA USTAWI WA JAMII
RESEARCH TASK FORCE

Simu: +255-24-2230189
E-mail: afya@zanlink

S.L.P 236
Zanzibar.

RTF/02/2004

13/07/2004

Katibu Mkuu,
Wizara ya Nchi (Afisi ya Rais) Katiba na Utawala Bora.
S. L. P 722.
Zanzibar.

OMBI LA KUFANYA UTAFITI JUU YA MFUMO WA HABARI ZA AFYA NDUGU YAHYA HAMAD SHEHE (IMPROVING ROUTINE HEALTH INFORMATION MANAGEMENT AT HEALTH DISTRICTS IN ZANZIBAR)

Tafdhali rejea barua yako yenye kumbukumbu LAA/LBAY/Y…/C/S/41 yenye kichwa cha habari inahusika.

Baraza la utafiti la Wizara ya Afya na Ustawi wa Jamii limepitia maombi ya utafiti wa Ndugu alietajwa hapo juu ambae ni mwanafunzi wa Chuo Kikuu cha Oslo, Norway ambaye anafanya shahada ya pili katika fani ya Kompyuta (Master in Informatics) na limeridhika na namna utafiti huo utavyofanyika. Baraza linatowa ruhusa kwa Nd. Hamad kuendelea na Utafiti wake.

Baada ya kumaliza utafiti atahitajiwa atume nakala moja kwa Baraza na pia atahitajiwa aandae "dissermination of research findings" kwa wadau.

Tunamtakia kila la kheri.

Ahsante,

(Dk. Ali Salim Ali)
Katibu
Baraza la Utafiti
Wizara ya Afya na Ustawi wa Jamii.
Zanzibar.

Nakala.
Nd. Yahya Hamad Shehe

Appendix A.5: Letter of permission from the Ministry of Health Pemba head office

WIZARA YA AFYA NA U/JAMII,
SANDUKU LA BARUA 98,
WETE PEMBA.

REF. NO: WAUJ/P/DHMT/M.I/3 **TAREHE 23/8/2004.**

DHMT WILAYA YA MICHEWENI,
PEMBA.

YAH: ND. YAHYA HAMAD SHEHE.

Nd. Niliemtaja hapo juu ni Mwanafunzi wa Chuo Kikuu cha Oslo Norway ambae anafanya shahada ya pili katika Fani ya Computer (Master Informatics)

Nd. Yahya kwa wakati huu yumo katika utafiti juu ya mfumo wa habari za afya (IMPROVING ROUTINE HEALTH INFORMATION MANAGEMENT AT HEALTH DISTRICTS IN ZANZIBAR).

Tafadhali mpokee na kumpa kila la msaada.

Ahsante,

RAMADHAN H. HAMIS.
/AFISA MDHAMINI,
WIZARA YA AFYA NA U/JAMII,
PEMBA.

Nakala :-
- Nd. Yahya Hamad Shehe.

Appendix B: Interview guide

Draft questionnaire

Interview:
Place and date:_____ Start time:_____ End time:_____
Institution: (PHCU level1/PHCU level 2/ PHCC/ District office/ Zonal office/ Headquarters office): _____
Interviewee:
Name: _____ Title/Post: _____
Professional: _____
Experience within health system:_____ Experience within the post:_____
Experience/Education level with HIS:_____

At headquarters

1. How is health system organised and how is HIS organized? Which department is responsible for HIS organization and monitoring? Is all health information reported to the department? If not, which is not and why?
2. What are the essential data sets collected. Which were the criteria used when establishing these data sets?
3. What are the common indicators calculated and used at the National level? What about other levels? How are these indicators used?
4. Which are the tools used to collect and gather data.
5. What are the reporting procedures? Which reports are supposed to be generated at each level? Is there a standard format for the reports? What are the reporting durations?
6. How is the information generated used?
7. Why was the previous HIS changed? Which was the design team? Did you get external technical assistance? Did health workers at HCFs and districts participate in the design process?
8. When exactly did Health sector reform start in Zanzibar? What is the relationship between the ongoing Health sector reform and the revision of the HIS?
9. What is the training programmes for HIS to the health personnel working with data? Is there any training at the health school? Do you have in-service training?
10. What are the general problems facing the current HIS. Which solutions do you propose?

Documents to collect: Reports (blank and historic from district to Zone and from zone to national)

Zonal offices

1. What are the general works of the Zonal office?
2. How is the information reported to the zonal office?
3. Do district hospital report to the zonal office or to the district offices?
4. Which reports are reported to the zonal office and which are reported to the National level from the zonal office?
5. Is there any indicators collected for the zonal office?
6. How is the information collected used for the management of the zone?

District offices

1. What is the structure of DHMT? What are its responsibilities?
2. Who is responsible for information collection from HCFs within DHMT? What are her other responsibilities?
3. What are the reporting procedures from HCFs to DHMT and from DHMT to Zonal office? Do you have telephone? Do DHMT have a proper transport?
4. Do you receive data from all programmes?
5. How do you consider maternity data from TBAs? How do you collect the data? How frequent? Do they report maternal and infant deaths? Are there specific forms to be filled by TBAs?
6. How do you consider the data from outreach?
7. Are you doing any analysis of the data you collect? Do you have calculators and computers? Do you think computers are necessary for data processing and analysis? How?
8. How many HCFs are in this district? Do all HCFs report timely? Who brings the forms to DHMT? How frequent do HCFs get the forms?
9. Do you check the forms brought from HCFs for completeness and accuracy? How do you know if the data are correct?
10. Where do you store the files and the forms?
11. How do you use the information you generate from these data?
12. Do ZHMT give any feedback from the reports you send them? How?
13. Do you give any feedback to HCFs? How? How frequent?
14. Did you get any training on the HMIS forms? Statistical training?

Observations: General office appearance, file storage, availability of officers
Documents: Historic data forms, reports produced.

At HCF:

1. What kinds of data are being collected at this HCF? Who collect which data? How and when is the data collected?
2. Which tools are used? Are the forms simple to use? Do you collect the forms or you receive them from the DHMT? Are the forms always available?
3. Who summarises the data? What are his/her other responsibilities? Did s/he receive any statistical training? Which tools does s/he use to aide the summary process? When/at what time do the summary process usually takes place?
4. Does the HCF have a calculator, computer, telephone, Internet, and a transport?
5. Where are the data stored? Do you have any problem with data storage?
6. Are you doing any analysis of the data you collect?
7. How much time is used to collect data? Analyse data?
8. What is the target population for this HCF? What is the source of these data? Do you know specific age groups for the whole population, e.g. children under 1 year? How many health workers are working at this HCF?
9. Do you use the information you get from the data you have collected? How?
10. Where do you send reports? How frequent? Which means of communication do you use?
11. Do you get feedback from DHMT? Which kind of feedback? How frequent?
12. Do you see any gap between data you need and the data you collect?
13. Did you get any training on the use of the forms? Did you attend any statistical training?
14. What problems you have in regards to data? Problems with the work process and working conditions?

15. What are your suggestions to improve the situation?

For TBAs

1. Can you read and write? What is your education level?
2. Where do you record births you attend? Is it simple work?
3. Where do you report these? How frequent? Do you get feedback?
4. Did you get any training on births attending? Did you get training on how to record these?
5. What do you consider to be Infant death/Maternal death? Do you record these? Do people come to notify you on these deaths after some time?

Appendix C: Reviewed documents from the fieldwork

Appendix C.1: Monthly MCH report (blank) from the HCF level to the district level

WIZARA YA AFYA NA U/JAMII
ZANZIBAR
HUDUMA ZA MAMA NA WATOTO IDARA YA KINGA

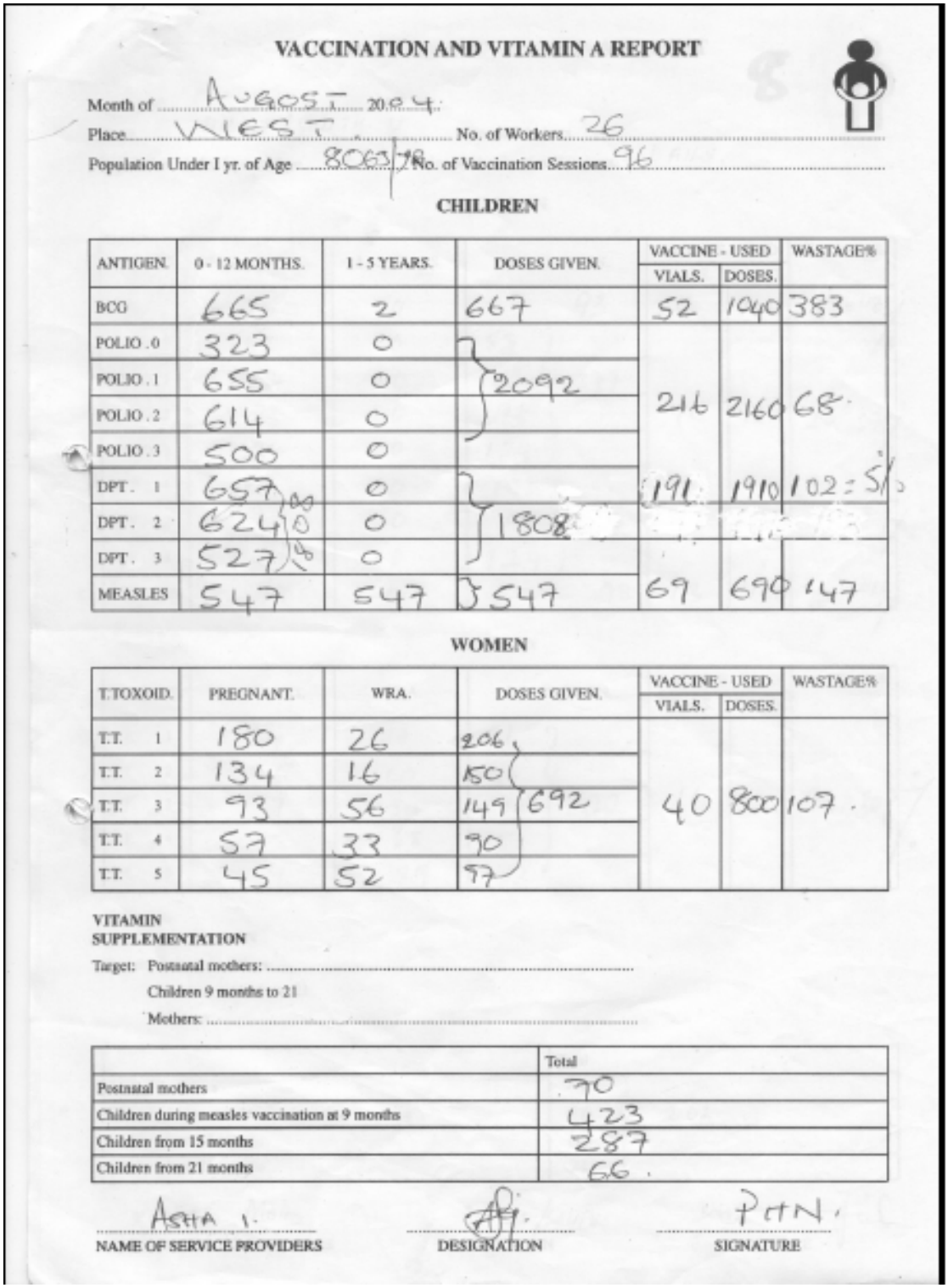
Jina la kituo.....Sahihi ya Mfanyakazi.....
Mwezi..... Mwaka.....

TAARIFA YA MAHUDHURIO YA MWEZI.

Idadi ya siku za kazi.....		MAHUDHURIO YA KWANZA	MAHUDHURIO MARUDIO.
WATOTO	- Chini ya mwaka 1	.....	.....
	- Mwaka 1 – miaka 5	.....	.....
	- JUMLA	.....	.....
MAMA	- Kabla ya wiki 32	.....	.....
	- Wiki 32 na baadae	.....	.....
	- JUMLA	.....	.....

MAGONJWA YA MATATIZO YA MWEZI		JUMLA
WATOTO	- Uzito upungufu 60-80%	.....
	- Unyafunzi (kwashiakoo)	.....
	- Upungufu mkubwa wa damu	.....
	- Kuharisha	.....
	- Surua	.....
	- Kifaduro	.....
	- Magonjwa mengine magumu kwako	.....
MAMA	- Blood pressure zaidi ya 140/90	.....
	- Upungufu mkubwa wa damu	.....
	- Mimba 8 au zaidi	.....
	- Matatizo ya uzazi wa majira	.....
	- Magonjwa mengine magumu kwako	.....
	- Normal deliveries	.....
	- MCH Deliveries	.....
	- TBAs	.....
	- Primary infertility	.....
	- Secondary infertility	.....
	- Green	.....
	- Gray	.....
	- Red	.....

Appendix C.2: Monthly report for the EPI Programme from the HCF level to the district level



VACCINATION AND VITAMIN A REPORT

Month of AUGUST 2004

Place WEST No. of Workers 26

Population Under I yr. of Age 8063/78 No. of Vaccination Sessions 96

CHILDREN

ANTIGEN.	0 - 12 MONTHS.	1 - 5 YEARS.	DOSES GIVEN.	VACCINE - USED		WASTAGE%
				VIALS.	DOSES.	
BCG	665	2	667	52	1040	383
POLIO .0	323	0				
POLIO .1	655	0	2092			
POLIO .2	614	0		216	2160	68
POLIO .3	500	0				
DPT. 1	657	0		191	1910	102 = 5%
DPT. 2	624	0	1808			
DPT. 3	527	0				
MEASLES	547	547	547	69	690	147

WOMEN

T.TOXOID.	PREGNANT.	WRA.	DOSES GIVEN.	VACCINE - USED		WASTAGE%
				VIALS.	DOSES.	
T.T. 1	180	26	206			
T.T. 2	134	16	150			
T.T. 3	93	56	149 692	40	800	107
T.T. 4	57	33	90			
T.T. 5	45	52	97			

VITAMIN SUPPLEMENTATION

Target: Postnatal mothers: .....

Children 9 months to 21

Mothers: .....

	Total
Postnatal mothers	70
Children during measles vaccination at 9 months	423
Children from 15 months	287
Children from 21 months	66

ASHA I. — NAME OF SERVICE PROVIDERS

AJ. — DESIGNATION

PATN. — SIGNATURE

Appendix C.3: Vaccination trends graphs prepared at the HCFs / DHMTs

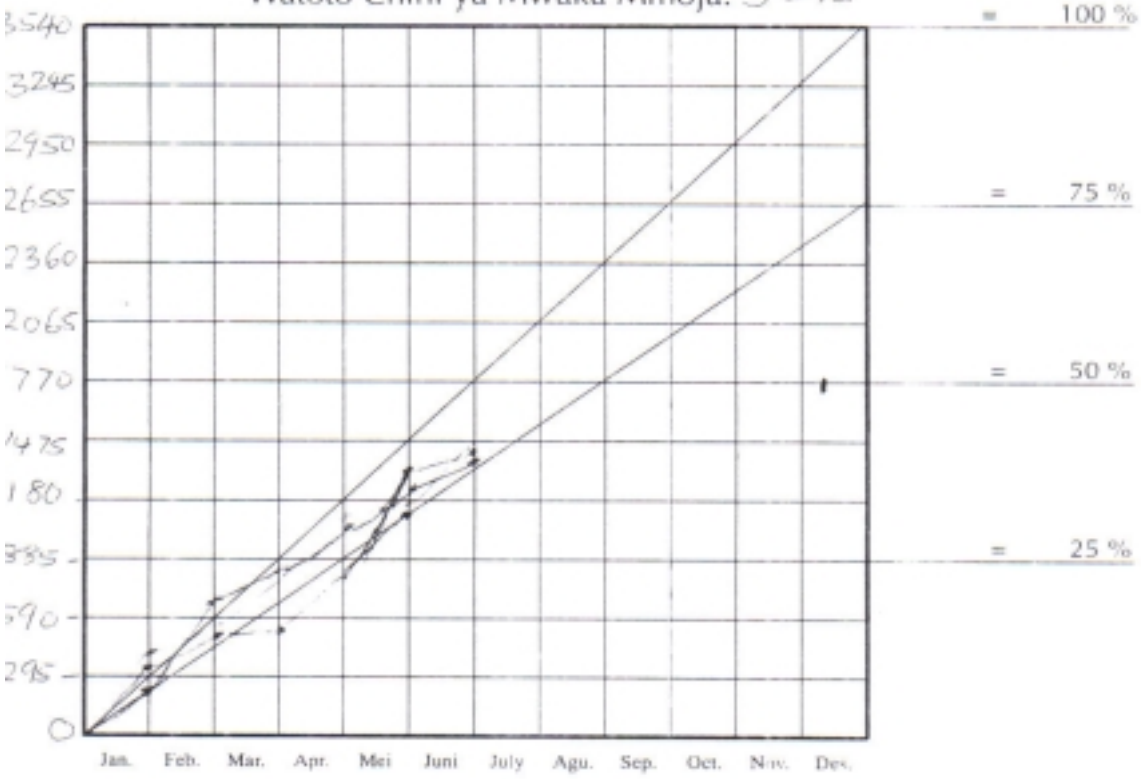
WIZARA YA AFYA UTIBABU
ZANZIBAR

Taarifa za Utendaji

Kituo cha Afya: NORTH 'A' DISTRICT - 2004

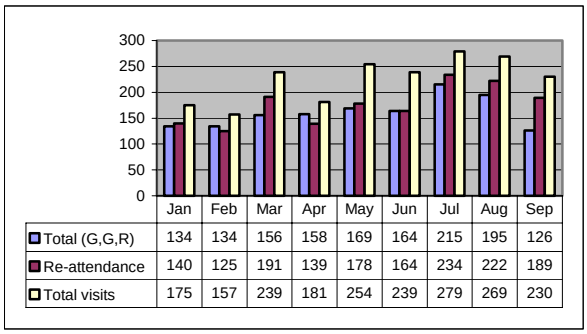
Chanjo: OPV

Watoto Chini ya Mwaka Mmoja: 3545



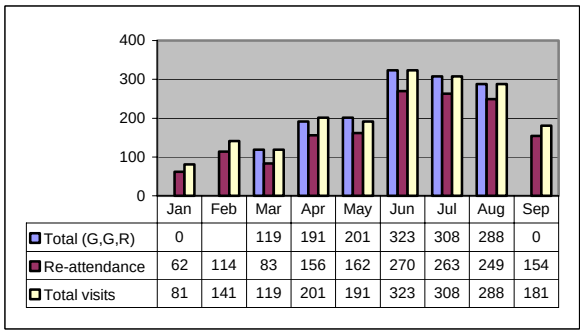
1	223	180	191	259	258	288							Idadi ya waliochanjwa kwa Mwezi.
	928	813	544	757	1035	1327							Idadi ya waliochanjwa kwa Mwaka hadi sasa.
2	382	175	287	163	212	306							Idadi ya waliochanjwa kwa Mwezi.
	362	450	451	250	1162	1468							Idadi ya waliochanjwa kwa Mwaka hadi sasa.
3	313	304	258	171	247	225							Idadi ya waliochanjwa kwa Mwezi.
	313	617	871	1128	1195	1420							Idadi ya waliochanjwa kwa Mwaka hadi sasa.

Appendix C.4: Graphs showing analysis of children attendance data from MCH monthly reports of the HCFs visited for the period of Jan – Sep 2004.



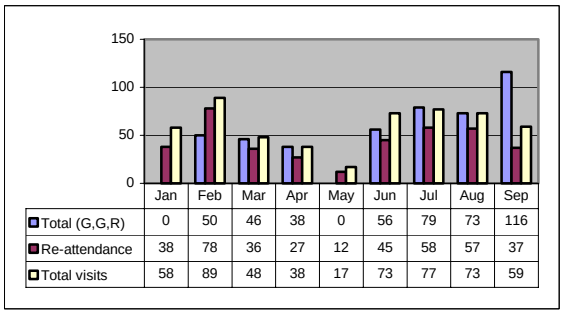
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Total (G,G,R)	134	134	156	158	169	164	215	195	126
Re-attendance	140	125	191	139	178	164	234	222	189
Total visits	175	157	239	181	254	239	279	269	230

Micheweni Cottage Hospital, Micheweni



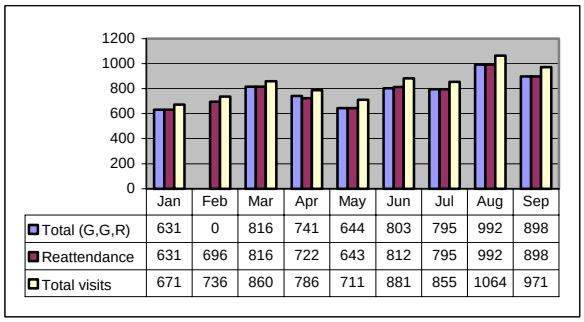
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Total (G,G,R)	0		119	191	201	323	308	288	0
Re-attendance	62	114	83	156	162	270	263	249	154
Total visits	81	141	119	201	191	323	308	288	181

Tumbe PHCU, Micheweni



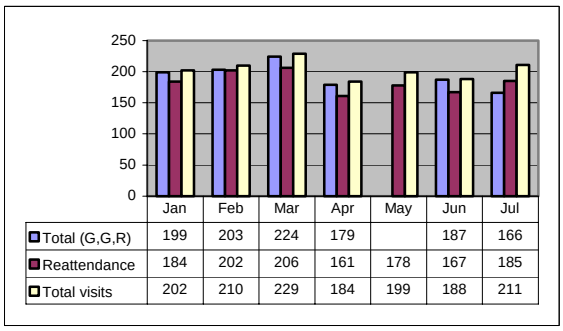
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Total (G,G,R)	0	50	46	38	0	56	79	73	116
Re-attendance	38	78	36	27	12	45	58	57	37
Total visits	58	89	48	38	17	73	77	73	59

Shumba Viamboni PHCU, Micheweni



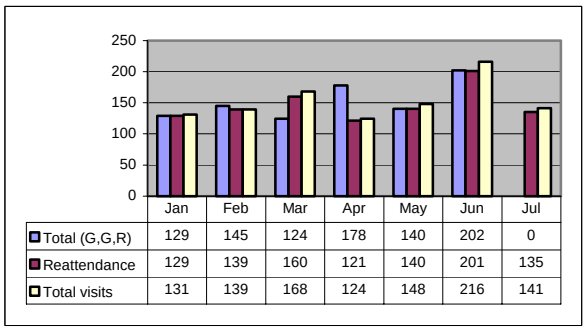
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Total (G,G,R)	631	0	816	741	644	803	795	992	898
Reattendance	631	696	816	722	643	812	795	992	898
Total visits	671	736	860	786	711	881	855	1064	971

Kivunge Cottage Hospital, North 'A'



	Jan	Feb	Mar	Apr	May	Jun	Jul
Total (G,G,R)	199	203	224	179		187	166
Reattendance	184	202	206	161	178	167	185
Total visits	202	210	229	184	199	188	211

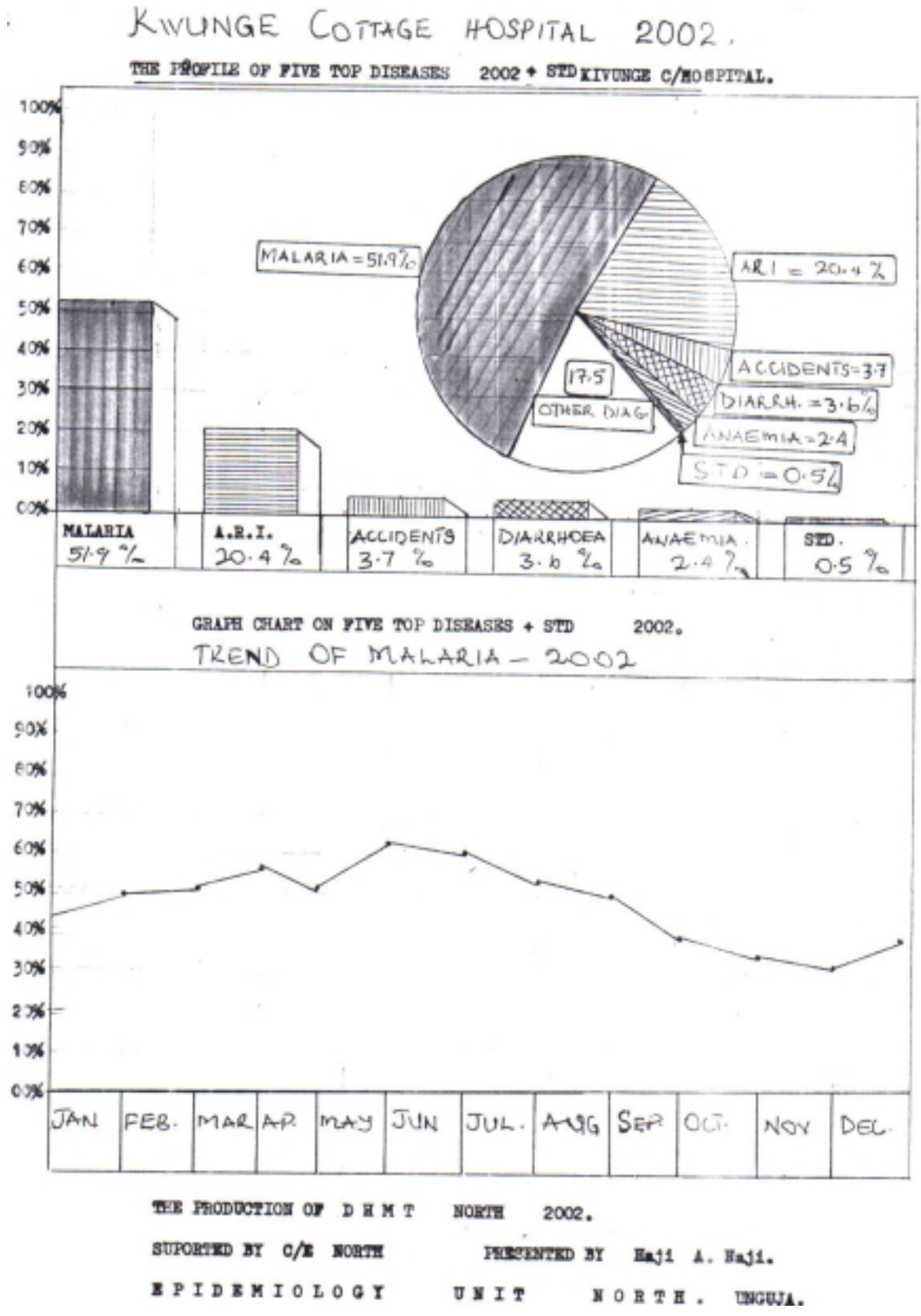
Mkoktoni PHCU, North 'A'



	Jan	Feb	Mar	Apr	May	Jun	Jul
Total (G,G,R)	129	145	124	178	140	202	0
Reattendance	129	139	160	121	140	201	135
Total visits	131	139	168	124	148	216	141

Chaani Masingini PHCU, North 'A'

Appendix C.5: Graphs and charts prepared at Kivunge Cottage Hospital



Appendix D: Reports prepared during the fieldwork
Appendix D.1: Roadmap

Roadmap to the implementation of HMIS in Zanzibar
(*as agreed in the stakeholders workshop at Aecrotanal conference hall Dec 04, 2004)*

Task force:

1. Head of HMIS
2. Vertical programmes representative: Mr. Rashid
3. Representative EPI
4. Planning unit, DANIDA
5. Representative from Mnazi Mmoja Hospital
6. ZMO (Unguja and Pemba)

Steps:

- Start using the new HMIS forms in North Unguja districts and Micheweni district (**Jan 2005**)
    - Logistics
    - Stationeries
    - Training
    - Monitoring and supervision

Responsible: DHMTs, task force; Budget: HSPS III

- Reviewing the forms (**April 2005**)
    - Data quality / availability
    - Identify minimum essential datasets / indicators at each level
    - Re-design the new integrated forms

Responsible: Task force, stakeholders, consultancy; Budget: WHO/NORAD, DANIDA (HISP)

- Continue the use of the revised forms in Unguja North districts and Micheweni district (**April – July 2005**)

Responsible: DHMTs, task force; Budget: HSPS III

- Review, refine and prepare for dissemination to all 10 districts (**July 2005)**
    - Logistics
    - Stationeries
    - Training
    - Monitoring and supervision

Responsible: Task force, stakeholders, consultancy; Budget: WHO/NORAD, DANIDA (HISP)

- Rolling out (**2nd half 2005**)

IT support

- District Health information Software (DHIS) will start to be used
- Support all data/reporting forms and indicator activities
- Adapting to needs (when revised)

- Training/facilitation (6 people to be sent to Mainland for training course in March 05 and October 05 – HMIS, DHMT North A and B and Micheweni district, 1 HMIS designer); arrange for the course in Zanzibar latter.
- Technical support
- Specify and accommodate other needs (GIS)

Mnazi Mmoja Hospital, District hospitals and cottage hospital

- Part of HMIS process
    - Hospital data forms (management of out/in patients)
    - Patients movement and management
    - Disease reporting
- Filing system at MMH

Appendix D.2: Technical report prepared by the software technical team

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Ministry of Health and Social Welfare Zanzibar

TECHNICAL REPORT FOR DHIS IMPLEMENTATION PLAN

By

Yahya Hamad
University of Oslo,
yahyasheykh@hotmail.com

Abubakar Diwan
The State University of Zanzibar
cadin25@hotmail.com

Juma Lungo
University of Dar es Salaam,
University of Oslo,
jlungo@udsm.ac.tz

Preamble: In three days, three Computer Technical Personnel have been discussing approaches for implementing the District Health Information Software (DHIS) in Zanzibar Ministry of Health. A preliminary technical approach for implementing Geographical Information Software (GIS) was also discussed and is presented in this report.

Unit of Analysis: The DHIS is software for Collecting, Collating, Storing, and Analysing Health Data. In this case the DHIS will be installed at the DHMT, ZHMT, HMIS, and Vertical Programmes offices. Thus, monthly reports from all Health Facilities in the respective districts will be registered in the Software at the DHMT. The software will generate reports for DHMT uses and other stakeholders. Electronic transfer of data will take place from DHMT to higher levels offices (ZHMT, HMIS, and Vertical Programmes).

DHIS Setup: In setting up the DHIS database, it requires to load all health facilities names and their categories; load all health data elements; and all health indicators Data elements and Indicators will be copied as they appear on the new ZHMIS forms. Initially the DHIS will be loaded with data elements from the following ZHMIS forms: EPI and Safe motherhood (at the time writing these forms are DHMT 07; and DHMT 05).

Tentative Plan:
January – June 2005: Deliverable - Complete database of all health facilities; data elements; and respective indicators with sample data.

- Piloting DHIS in two districts namely North A and North B with the agreed data elements (EPI and Safe Motherhood). Including user training
- Conducting feasibility study for implementing GIS application (collecting maps with codes for health facilities and integrating a GIS application with the DHIS database).
- Prototyping health data from other programmes in the DHIS software.

July - December 2005: Deliverable – health data and official reports from the DHIS.

- Rolling up the DHIS in all districts in Unguja and Pemba with data from all programmes. This include user training
- Prototyping GIS software

From January 2006:

- Full implementation of both DHIS and GIS
- Software Maintenance and user support

Technical Team:

- Researchers / consultants
- One personnel from the Ministry of Health
- One computer programmer (Abubakar Diwan from The State University of Zanzibar)

Organisation of Technical Team:

While the team will be working together in Zanzibar, other means of communication will be used. This include email and project website.

Reporting of Deliverables:

All deliverables will be submitted to the HMIS roadmap taskforce as will be agreed