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**Department of Informatics**

**Challenges and approaches  
to the integration of HIS:  
Case studies from Tanzania**

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**CHALLENGES AND APPROACHES TO THE  
INTEGRATION OF HIS: CASE STUDIES FROM  
TANZANIA**

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**ABSTRACT**

This research falls under the area of design and implementation of information systems in developing countries. I have studied the health information systems in Tanzania using case studies in Ilala Municipal, situated in Dar es Salaam city, and Tabora Municipal in the Tabora region. The purpose of the research was to study the challenges encountered by the health workers at the local level with regard to information collection, use and reporting. The focus of this thesis is on problems of fragmentation and challenges of integration. These have been studied both with regard to the routine health information system (MTUHA) in general, and specifically for the programme for prevention of mother-to-child transmission of HIV/AIDS (called PMTCT), which is relatively new and was supposed to become fully integrated with the ordinary health service structures. The research had been carried out as part of the Health Information Systems Programme (HISP) initiative, an international research and development project based in the Informatics department of the University of Oslo.

The empirical fieldwork was conducted between 1<sup>st</sup> of July 2004 and 18<sup>th</sup> of January 2005. The study employed qualitative research methods, including; ethnographic interviews, participation in workshops, document analysis in the health facilities, and hands-on experience with existing computer systems in the district. The empirical data were analysed using the principles of qualitative research, and the analysis was informed by my theoretical framework.

My theoretical framework is based on a literature review that covers research from various fields, including literature on health information systems (HIS) in developing countries, research on information infrastructures and on integration of information systems. I argue that rather than seen as information systems, HIS should be conceptualised as larger systems consisting of human and non-human components, where the design of new information system is done by gradually extending the existing HIS, rather than from scratch. Developing an information system involves not only a technical solution but also social considerations, and a socio-technical approach is, therefore, appropriate. I draw upon the metaphor of installed base cultivation, and the emphasis on incremental and bottom-up approaches that this perspective entails.

The findings indicated that the HIS performance is hindered by the fragmentation within and across the HIS. Fragmentation creates duplication of work and data, lack of information sharing, and poor quality of information, poor use of information and hindering of health care service provision. As an organising framework to describe the findings, I categorise them into four dimensions: fragmentation problems related to software, to data, to work practices and to institutional factors. At the system's level, the problems are inflexible code, poor performance of the computerised system, and different software between programmes. At the level of specific data items, I identify a serious problem related to identification of clients to the PMTCT programme, with consequences for follow-up. The information integration with the rest of the MCH health care services was weak. In terms of work practices, the study revealed problems related to information sharing between PMTCT staff and other staff. At the institutional level, the problems of patients (or clients) attending several and different clinics is a challenge. The causes for the fragmentation problems include low priority for HIS work, information flow reflecting higher needs, and lack of participation in system development.

However, the study also revealed some instances of emergence of local improvised tools designed by health workers at the facility level, which was also being spread horizontally and

## *ABSTRACT*

used by other facilities. These tools can resolve (at least partly) the dilemmas of integration, and they address the immediate information needs of the workers. Based on these findings and on insight gained from theory, I end by proposing some cultivation strategies for dealing with the challenges identified in the research. Bottom-up standardisation and “loose” integration are central aspects here.

**Keywords: Data, information, integration, fragmentation, health information systems, PMTCT, RHMIS, Tanzania, and information infrastructures**

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# TABLE OF CONTENTS

<b>ABSTRACT</b> .....	<b>i</b>
<b>ACKNOWLEDGEMENT</b> .....	<b>iii</b>
<b>TABLE OF CONTENTS</b> .....	<b>iv</b>
<b>List of figures, photos and tables</b> .....	<b>vii</b>
List of figures .....	vii
List of photos .....	vii
List of tables .....	viii
<b>List of acronyms</b> .....	<b>ix</b>
<b>INTRODUCTION</b> .....	<b>1</b>
<b>1.1 Study background and problem domain</b> .....	<b>1</b>
<b>1.2 Overview of theoretical perspective</b> .....	<b>5</b>
<b>1.3 Study context and research approach</b> .....	<b>6</b>
<b>1.4 Expected contributions</b> .....	<b>7</b>
<b>1.5 A summary of the thesis chapters</b> .....	<b>7</b>
<b>LITERATURE REVIEW AND THEORETICAL FRAMEWORK</b> .....	<b>9</b>
<b>2.1 Health Information System (HIS)</b> .....	<b>9</b>
<b>2.2 Information infrastructures (IIs)</b> .....	<b>13</b>
2.2.1 Conceptualisation of Health information infrastructure .....	16
<b>2.3 Integration of Information systems</b> .....	<b>18</b>
2.3.1 Defining Integration of information systems .....	18
2.3.2 Scope of integration .....	20
2.3.3 Degree of integration .....	22
<b>2.4 Theoretical framework for analysis</b> .....	<b>23</b>
<b>2.5 Summary</b> .....	<b>25</b>
<b>STUDY CONTEXT AND RESEARCH APPROACH</b> .....	<b>26</b>
<b>3.1 Study context</b> .....	<b>26</b>
3.1.1 Situation analysis of Tanzania .....	26
3.1.2 Organisation of health care in Tanzania .....	28
3.1.2.1 Mother and Child health care .....	30
<b>3.2 Research approach</b> .....	<b>30</b>
3.2.1 Research genesis .....	30
3.2.2 Research design .....	31
3.2.2.1 Tabora Municipal background .....	32
3.2.2.2 Ilala Municipal background .....	34
3.2.2.3 Research process .....	36
3.2.3 Research methods .....	39
3.2.3.1 Sources of information .....	40
3.2.3.1.1 Interviews .....	40
3.2.3.1.2 Document analysis: .....	41
3.2.3.1.3 Experimenting with the system .....	42
3.2.3.1.4 Participation in the workshop .....	42
3.2.3.1.5 Empirical data analysis and interpretation .....	43
3.2.3.2 Data reliability .....	43
3.2.3.3 Ethical issues in data collection .....	44
3.2.3.4 Access and study limits .....	45
<b>3.3 Summary</b> .....	<b>45</b>
<b>RHMIS (ROUTINE HEALTH MANAGEMENT INFORMATION SYSTEM) CASE STUDY</b> .....	<b>46</b>
<b>4.1 Background of the HMIS in Tanzania</b> .....	<b>46</b>
<b>4.2 RHMIS at the district level</b> .....	<b>50</b>
4.2.1 Software related issues .....	50
4.2.1.1 Lack of flexibility .....	50
4.2.1.2 Poor analysis of data .....	51
4.2.1.3 Non-functioning features .....	54
4.2.1.4 Different software systems: .....	55

4.2.2 Data related -----	55
4.2.2.1 Different age categories between EPI and MTUHA -----	55
4.2.2.2 Difference in label instructions provided by the electronic and manual forms -----	56
4.2.2.3 Difference of fields -----	57
4.2.3 Work practices related -----	58
4.2.3.1 Different working practices for different programmes -----	58
4.2.3.2 Different instructions for entering data in the implementation of the district database -----	58
4.2.3.3 Different means of data collection and accessing information -----	58
4.2.4 Institutional related -----	59
4.2.4.1 Lack of flexibility and missing data -----	59
<b>4.3 Summary -----</b>	<b>61</b>
<b>HIS FOR PMTCT PROGRAMME: CASE STUDY -----</b>	<b>63</b>
<b>5.1 Background of the PMTCT programme in Tanzania -----</b>	<b>63</b>
<b>5.2 Case study of the HIS for PMTCT -----</b>	<b>66</b>
5.2.1 The Information process in the PMTCT -----	66
5.2.2 Software related -----	68
5.2.3 Data related -----	68
5.2.3.1 Before the introduction of registers -----	68
5.2.3.2 After the introduction of official registers -----	70
5.2.3.3 Local tools found in the study -----	72
5.2.2.3.1 Before the introduction of the registers -----	73
5.2.2.3.2 After the introduction of the registers -----	74
5.2.2.3.3 Partner information management -----	77
5.2.4 Work practices related -----	79
5.2.5 Institution related -----	82
5.2.5.1 Clients identification -----	82
5.2.5.2 Communication between facilities -----	87
<b>5.3 Summary -----</b>	<b>89</b>
<b>ANALYSIS AND DISCUSSION -----</b>	<b>91</b>
<b>6.1 Fragmentation Problems -----</b>	<b>92</b>
6.1.1 The effects of fragmentation -----	94
<b>6.2 The problem of fragmentation: the role of the installed base -----</b>	<b>94</b>
6.2.1 RHMIS installed base and fragmentation problems -----	94
6.2.1.1 Comparison between the computerised systems in the two districts -----	96
6.2.2 Role of the installed base: PMTCT programme -----	97
6.2.2.1 Comparison between the PMTCT programmes in the two districts -----	98
6.2.3 Comparison across the cases programmes -----	99
<b>6.3 Strategies for improving the information systems -----</b>	<b>99</b>
6.3.1 Cultivation approach for integrating HIS -----	100
6.3.1.1 Avoiding fragmentation -----	100
6.3.1.2 Selective integration -----	101
6.3.1.3. Proposal for robust client identification scheme -----	103
<b>CONCLUSIONS -----</b>	<b>105</b>
<b>7.1 Research summary -----</b>	<b>105</b>
<b>7.2. Research contributions -----</b>	<b>108</b>
7.2.1 Theoretical contributions -----	108
7.2.2 Practical contributions and recommendations -----	110
<b>7.3 Further research -----</b>	<b>111</b>
<b>BIBLIOGRAPHY -----</b>	<b>112</b>
<b>APPENDICES -----</b>	<b>118</b>
<b>Appendix A: Ethical clearance -----</b>	<b>118</b>
Appendix A.1: Letter of introduction to the Ministry of Health from the University of Oslo. -----	118
Appendix A.2: Letter of permission from the Ministry of Health Tanzania -----	120
Appendix A.3: Example of introduction letters from the Ilala Municipal -----	121
Appendix A.4: Example of Introduction letters from the Tabora Municipal -----	122
Appendix A.5: Example of extra introduction letter acquired after the research focus shift -----	123
<b>Appendix B: Interview guide -----</b>	<b>124</b>
Appendix B1: Questions in the first phase: -----	124

## TABLE OF CONTENTS

Appendix B2: Questions in the second phase: -----	124
Appendix B3: Questions regarding the database: -----	124
Appendix B.4: Number of interviews conducted during fieldwork -----	125
<b>Appendix C: Reviewed documents from the fieldwork -----</b>	<b>127</b>
Appendix C.1: Ilala Municipal profile cover page -----	127
Appendix C.2: Copy of top ten disease lists from the Ilala Municipal profile-----	128
Appendix C.3: The manual MTUHA form with explanation of indicators -----	129
Appendix C.4: Former ANC PMTCT register (blank) -----	130
Appendix C.5: Current ANC PMTCT register (blank)-----	131
Appendix C.6: Current Maternity PMTCT register (blank) -----	132
Appendix C.7: Monthly summary form for the ANC PMTCT programme from facility level to district level (blank) -----	133
Appendix C.8: Data processing for PMTCT at national level (blank)-----	134



## **List of figures, photos and tables**

### **List of figures**

Figure 3.1: A map of Tanzania.....	27
Figure 4.1: Computer system report creation (initial screen).....	51
Figure 4.2: Examples of generalised reports from the computer system .....	52
Figure 4.3: Local data folder from a district.....	53
Figure 4.4: Quarterly reports (F004) with vaccination data elements.....	55
Figure 4.5: EPI form with vaccination data elements .....	56
Figure 4.6: E-form depicting population with no explanation .....	57
Figure 4.7: Form depicting the three fields in the electronic form.....	57
Figure 4.8: Example of dispensary form with outpatient diagnostic data .....	60
Figure 4.9: Electronic version of outpatient diagnostic data which was disabled for dispensaries.....	60
Figure 5.1: Vicinity between some facilities and client houses .....	84

### **List of photos**

Photo 4.1: Computer and facility folder reports storage .....	49
Photo 5.1: PMTCT activities: testing and public health education activities.....	65
Photo 5.2: The ANC and Maternity PMTCT registers.....	67
Photo 5.3: Register page showing the record of male partner client.....	71
Photo 5.4: A page on the register, showing the client who came after post delivery for a second test.....	72
Photo 5.5: A local register found in one facility.....	74
Photo 5.6: The local register with antenatal number and initial names.....	76
Photo 5.7: Form used for each client with additional details .....	77
Photo 5.8: Information tools which include the folder with partner information....	78

Photo 5.9: Male partner register in one facility ..... 79

Photo 5.10: The antenatal register with address on top ..... 85

**List of tables**

Table 3.1: Distribution of health facilities in the country in the year 2000 ..... 29

Table 3.2: Distribution of health facility types and ownership at the Tabora Municipal ... 33

Table 3.3: Distribution of health facility types and ownership at the Ilala Municipal ..... 35

Table 3.4: Facilities visited during the first phase ..... 38

Table 3.5: Facilities visited during the second phase ..... 38

Table 4.1: Routine data collection tools of Mother and Child Health in Tanzania ..... 48

Table 4.2: Example of facilities with outpatient diagnosis data ..... 59

Table 4.3: Summary of the integration challenges observed in the RHMIS ..... 62

Table 5.1: Data collected in the local registers in different facilities ..... 73

Table 5.2: The various HIV codes used in the region ..... 88

Table 5.3: PMTCT clients from different geographical areas ..... 89

Table 5.4: Summary of integration challenges in the PMTCT HIS ..... 90

Table 6.1: Summary of fragmentation effects observed in the study ..... 94

Table 6.2: Illustration of identification number from the University of Dar es salaam ..... 103

Table 6.3: Examples of unique antenatal number ..... 103

**List of acronyms**

AIDS .....	Acquired Immune Deficiency Syndrome
ANC .....	Antenatal Care
ARV/ART .....	Anti- Retro Viral
DANIDA .....	Danish International Development Agency
DHMT .....	District Health Management Team
DMO .....	District Medical Officer
EPI.....	Expanded Programme for Immunisation
EU .....	European Union
FHMIS.....	Family Health Management Information System
FP .....	Family Planning
HII .....	Health Information Infrastructures
HIS .....	Health Information System
HISP .....	Health Information System Programme
HIV.....	Human Immune Deficiency Virus
HMIS.....	Health Management Information System
II .....	Information Infrastructure
IS .....	Information System
MCH.....	Maternal and Child Health
MMOH.....	Municipal Medical Office of Health
MTUHA.....	Mfumo wa Taarifa za Uendeshaji Huduma Za Afya
NGO .....	Non Government Organisation
PMTCT .....	Prevention of Mother To Child Transmission of HIV
RCH.....	Reproductive and Child Health
RHMIS .....	Routine Health Management Information Systems

*LIST OF ACRONYMS*

STI/D.....Sexually Transmitted Infection/Disease

TB.....Tuberculosis

VCT.....Voluntary Counselling and Testing

WHO .....World Health Organisation

## **Chapter 1**

### **INTRODUCTION**

This chapter introduces the theme of this study and takes the reader to the overall issues addressed. This research addresses the issue of design and implementation of health information systems in the context of developing countries. The study draws upon insights from the socio-technical studies of technology, in which an information system is not simply a technical-rational process of ‘solving problems’; but also involves economic and social processes.

This chapter is structured as follows. Section 1.1 presents the study background, problem area and personal motivation, while Section 1.2 provides the overview of the theoretical focus which guides my research investigation. Sections 1.3 and 1.4 present the study context, including the research approach and the expected contributions, respectively. Lastly, a summary of this thesis’ chapters is presented.

#### ***1.1 Study background and problem domain***

Sub-Saharan Africa is the region of the world that is most affected by HIV/AIDS, with estimates ranging from 26.6 million people currently infected and approximately 3.2 million new infections being added in 2003. In just the past year, the epidemic has claimed the lives of an estimated 2.3 million Africans. Ten million young people (aged 15-24) and almost 3 million children under 15 are living with HIV. An estimated eleven million children have been orphaned by AIDS in Sub-Saharan Africa (see [www.avert.org](http://www.avert.org)).

Promoting healthy behaviour and increasing knowledge about pregnancy and pregnancy-related complications among women, families and communities are essential to the health and well-being of pregnant women (see [www.who.int/reproductive-health](http://www.who.int/reproductive-health)). The health of pregnant women can be improved through effective antenatal care, which also increases a mother's chances of giving birth to a healthy baby. While any woman can develop complications during pregnancy and delivery, many such complications can be prevented or treated before they become life-threatening emergencies, and be managed by appropriately trained and equipped health care providers.

Antenatal care is provided during periods of pregnancy, enabling the opportunity for discussion between a pregnant woman and a health care provider about healthy behaviour during pregnancy (such as gaining adequate nutrition), about recognising complications that may arise, and to make a delivery plan that will meet the needs of the individual woman. Antenatal care is important also for preventive care, including tetanus toxoid immunisation and provision of iron/folic acid tablets to prevent and treat anaemia. Finally, antenatal care is important for early diagnosis and prompt treatment for complications and illnesses that can arise during pregnancy, such as sexually transmitted diseases (STDs) and malaria (ibid). In contemporary times, HIV/AIDS is being identified as a growing complication during pregnancy. For instance, in 1990 the antenatal care services in Thailand began routine screening for HIV infection in antenatal clinics in order to identify women who were infected, and thus provide prevention of HIV transmission to their partners and also to health care workers during delivery (Kanshana and Simonds 2002).

In 2003 about 700,000 infants globally became infected with HIV, mainly through mother to child transmission (MTCT). Infants of HIV-infected mothers are at a greater risk of becoming infected during childbirth. Most infants who acquire HIV in labour and delivery do so by swallowing, or aspirating maternal blood or cervical secretions. About 90% of these infections occurred in Sub-Saharan Africa with dramatic adverse effects on various facets of society. AIDS is beginning to reverse decades of steady progress in child survival rates. But effective and feasible interventions to reduce mother-to-child transmission are now available and could save the lives of thousands children each year (see [www.avert.org](http://www.avert.org)). PMTCT (Prevention of Mother To Child Transmission of HIV) programme aims at reducing risks of transmission from mother to children during antenatal and delivery periods by using antiretroviral drugs (ART) to positive mothers and syrups to the new born baby.

One key element of continuity of care in PMTCT is keeping a record which summarises the care and allows each health worker or counsellor to understand what has happened before: the patient's HIV clinical stage, what medical care, education, and psychosocial support have been provided on earlier visits; and a summary of the patient's ART (antiretroviral) therapy (WHO 2004: 35). To support PMTCT management, there is a need to develop a proper health information system (HIS), which will be required to generate appropriate information to be used by health planners and decision-makers to properly manage healthcare at all levels.

The Health Information System can be defined as “a combination of vital and health statistical data from multiple sources, used to derive information about the health needs, health resources, costs, use of health services, and outcomes of use by the population of a specified jurisdiction” (Nsubuga 2001: 60). A health information system cannot exist by itself but is a functional entity within the framework of a comprehensive health system that offers integrated health services, including curative care, rehabilitative care, disease prevention, and health promotion services (Sauerborn and Lippeveld 2000:17). The health information system structure should permit generation of the necessary information for improved decision making at each level of the health system by strengthening the processes of data collection, processing, reporting, and use of information.

For effective running of PMTCT, information is needed from different sources such as laboratory, pharmacy, maternity wards, counselling and should be integrated in a meaningful way so that it is useful for the programme managers. These information needs are often not met in an adequate way. Therefore, there is a need to strengthen the HIS through better information integration in order to support PMTCT, given that its information comes from various sources, involving different organisations, practices, etc.

However, several studies have indicated that the performance of health management information system in developing countries to be largely ineffective (see for example RHINO 2001; Sauerborn and Lippeveld 2000; Lungo 2003; Mukama 2003; Chilundo 2004; Aanestad *et al.* 2005). The low performance is reflected in the duplication and waste among parallel information systems, poor quality of data, irrelevance of the data gathered, lack of timely reporting and feedback, and poor use of information (Sauerborn and Lippeveld 2000:5). The duplication and waste among parallel information systems contributes to redundant and overlapping information, and data transmission not following hierarchical lines of communication. Elimination of duplication and waste requires a unified (integrated) system rather than better coordination among the existing parallel structures (*ibid*). Integration of information system provides benefits, including for quick sharing of information at the organisation and reducing problems associated with fragmentation, such as duplication of work (Webster 1995; Monteiro 2003; Braa *et al.* 2005).

In fact, integration of HIS has been a historical problem for a variety of reasons identified by different researchers. For example, Chilundo (2004) showed how integration will be difficult to achieve in practice, the reasons being multiplicity of disease-specific programmes

supported by different donors, as well as the different nature of the diseases, such as TB, which require more attention and hence a better HIS (Chilundo 2004). It has also been demonstrated by different researchers that integration of HIS should not be viewed merely as concerning technical issues (Aanestad *et al.* 2005; Braa *et al.* 2005; Grimson *et al.* 2000; Webster 1995). To summarise, achieving an integration of the HIS is a complex process, since it involves broader problems such as socio-technical and historical ones. The main problem addressed in this research is that of tackling the problem of fragmentation in order to transform the existing health information system in developing countries into a tool to support decision-making. With this background, this study had the following research objectives:

1. To understand the challenges of integrating HIS, and the reasons for their fragmentation, more generally, and specifically in the context of the PMTCT and routine health management information systems, and
2. To study the particular approaches and strategies to deal with these challenges of integrating HIS, specifically within the context of integrating the PMTCT with the routine health management information systems.

The issues of fragmentations are thus the focus of this research, both in terms of a theoretical understanding, as well as practical strategies to deal with them.

The personal motivation for conducting this research stems from my background. I have grown up in Tabora town, in the interior part of Tanzania. The town is characterised by poor services in terms of water, roads and health. It was common for the health facilities in the town to run out of supplies such as drugs and materials for a period of half a month. As a result, we used the hospital just for consultation, and material (e.g. gloves) and drugs had to be acquired elsewhere. I believe that the improvement of HIS and strengthening management could potentially help tackle such problems. They are to some degree related to resource constraints, but also to deficient informational routines.

The area of Mother and Child Care has been chosen as my empirical focus because this consists of vulnerable groups of people. In developing countries, pregnancy and child mortality and morbidity rates are very high, mostly due to preventable causes. Quality service, which can reduce this problem, can be obtained by having better information systems which can be achieved through better integrated information systems. The next section presents the theoretical basis to guide the research investigation.



## **1.2 Overview of theoretical perspective**

Information systems can be defined as “*a set of organised procedures that, when executed, provide information for decision making, communications, and/or control of the organisation*” (Lucas 1992:7). Health information systems integrate data collection, processing, reporting, and use of the information necessary for improving health service effectiveness and efficiency through better management at all levels of health services (Sauerborn and Lippeveld 2000:3).

However, it has been argued by various researchers that the information system concept in developing countries needs a holistic approach, involving not only technical matters but also socio-economic ones. The problems associated with information systems in developing countries include poor quality data, lack of resources (material and human), lack of transport/communication and fragmentation of information systems caused by donor community (Sauerborn and Lippeveld 2000; Mukama 2003; Lungo 2003; RHINO 2001; Chilundo 2004).

An effective information system to support any healthcare organisation is a shared resource that evolves over time. Information systems of this kind are better described as information infrastructures, rather than as traditional information systems. Information systems 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). Thus, I argue that HIS can best be conceptualised as a Health Information Infrastructure (HII) as it is composed of heterogeneous social and technical components (such as health planners, physicians, health programme experts, government bodies, reporting formats, software, and work procedures). For example, the health system is subject to many changes such as introduction or removal of some programmes, or the emergence of new diseases for instance the Marbug virus and bird flu. Infrastructures are usually developed through extensions and improvements of the existing systems and will always be integrated into that existing system, called the installed base, which consists of different components, both technological and non-technological ones. The new system will always need to link, or be integrated with the old, installed base. Thus, the issue of integration is at the heart of II theory.

Specifically, two concepts of installed base and cultivation (Hanseth and Monteiro, 1998) are drawn upon from II theory, which I argue are potentially very useful analytical devices to

study the challenges of integrating the HIS. The notion of installed base informs us that the process of designing and improving an II, for example through integration, cannot start from scratch. It has to respect the historically existing installed base (for example the society's perception of HIV, social stigma, the existing information tools, work procedures etc.) as a point of departure in the development of the new extensions. The cultivation approach sees II development to be a long-term incremental strategy with the aim to extend and grow upon an existing installed base rather than to try to radically change it.

In summary, the II perspective helps to develop a broader and more holistic understanding of HIS as conceptualised as HII, and the concepts of installed base and cultivation offers analytical leverage to understand both the challenges to integrating the HIS, and also how they can be addressed in practical settings.

### ***1.3 Study context and research approach***

The study was conducted in Tanzania, which is one of the poorest countries in the world and located in Eastern Africa. The empirical focus is on two case studies; the RHMIS (routine health management information system) and PMTCT, with a focus on the challenges related to integration.

Since the research's focus was to develop a deep understanding of the challenges of integrating HIS, the PMTCT programme was chosen because it is a new programme which was supposed to be integrated with the old system; the routine health information system. Since the PMTCT clients are routine antenatal clinic clients, there is an obvious and immediate link between these two parts in terms of work processes and information wise.

The study belongs to the qualitative research tradition and has employed comparative case study approach, which was conducted in two districts (Ilala and Tabora) which are situated in two regions (Dar es Salaam and Tabora). The comparative case study design in both the programmes (PMTCT and RHMIS) and district-wise helped to understand deeply and in a context-specific manner what constitutes the challenges of integrating HIS, and secondly, to develop inter-case comparisons to identify similarities and differences.

Various health facilities offering reproductive healthcare service and district health offices were visited frequently by the researcher through the period between July 2004 and January 2005. The data collection methods were mainly based on interviews, document analysis,

experimenting with the computer system and informal discussions with health workers and district managers.

### ***1.4 Expected contributions***

This thesis is intended to contribute theoretical and practical knowledge for healthcare information systems workers, researchers in Information Systems (IS) and anyone who will have an interest in Health Information Systems (HIS) in general. While the thesis attempts to develop broader implications around the challenges and approaches of integrating HIS, the specific focus has been on the issues of design, development and implementation of the routine HMIS and the IS related to the PMTCT programme in developing countries, particularly Tanzania.

More specifically, the thesis contributes theoretically by developing a deeper understanding of the problems of fragmentation and the challenges of integration in developing countries, drawing upon an II perspective; installed base and cultivation concepts. Prior challenges of integrating HIS, already identified by different researchers, have been related to vertical programmes or sub-systems of HIS, which are coordinated differently from the national HIS. This thesis contributes in the theoretical knowledge; by more specifically arguing that fragmentation of information is not only observed in the separate sub systems of the overall HIS, but is also found within the individual sub-systems. Furthermore, the study offers practical and detailed recommendation on how to address particularly crucial problems related to integration of PMTCT and HIS in general.

### ***1.5 A summary of the thesis chapters***

This thesis is organised as follows: following the introduction chapter, the literature chapter is introduced in chapter two. Chapter two presents the theoretical perspectives, which are based on the concept of information infrastructures together with a broad layered and socio-technical view on integration. These concepts are used to organise and analyse the findings which are presented in chapters four and five. Chapter three provides the reader with information about the study context, the empirical setting and the research approach. Chapter four is the first case study which provides details of the routine health information system that is operating in Tanzania and its fragmentation problems. Chapter five presents fragmentation problems in the PMTCT healthcare information system. Chapter six provides analysis and

discussion of the empirical data by drawing upon our theoretical perspective (described in chapter two), and positions the findings within some of the wider debates in the IS literature relating to fragmentation problems. Finally, chapter seven presents some brief concluding remarks, including key contributions of the thesis, and the identification of some areas for further research. After the bibliography, appendices contain other materials such as introduction letters and some graphical empirical data.

## **Chapter 2**

### **LITERATURE REVIEW AND THEORETICAL FRAMEWORK**

This chapter presents the theoretical and conceptual framework which is based on a literature review in the domain of existing HIS in developing countries with a focus on the challenges and approaches to integration. Following this, I draw upon the information infrastructure theory as a conceptual lens to analyse these issues. The chapter starts by introducing the HIS domain in terms of definition overviews of routine and PMTCT components, and also presents the status of HIS in developing countries specifically related to fragmentation problems. In Section 2.2, I present the II perspective, and draw upon some key concepts relevant to my analysis. In section 2.2.1, I argue why HIS are best understood as IIs. Section 2.3 present the concepts related to integrating HIS and also emphasises the socio-technical nature of the problem. Section 2.4 provides the key concepts that I use as organising framework to present the empirical material and as analytical framework for the empirical material. Section 2.5 presents the chapter summary.

#### ***2.1 Health Information System (HIS)***

Information is crucial at all management levels of the health services, from the periphery to the centre, for policy makers, managers, care providers, including doctors, health technicians, and community health workers (Sauerborn and Lippeveld 2000:1). To generate the required information for various needs in the health sector, data can be collected through variety of ways including routine method (Lippeveld 2000).

Lippeveld (2001) defines routine health information as “information that is derived at regular intervals of a year or less through mechanisms designed to meet predictable information needs” (Lippeveld 2001:11). Routine method involves collection and reporting of data from the basic health services at community level, health centres, dispensaries, first-level hospitals, referral hospitals, and special and tertiary hospitals.

The most common type source of routine health data is health unit based where data are recorded by the health staff within the facility while performing their regular daily health care activities on various health programmes; Mother and Child Health (MCH), communicable diseases, Tuberculosis and Drug programmes (Lippeveld 2000). Therefore, routine service

## *LITERATURE REVIEW AND THEORETICAL FRAMEWORK*

reports may include primary health care hospital reports, TB quarterly reports and environmental health reports (Wilson *et al.* 2001:83) and HISs for administration such as for finance, drugs and supplies, physical assets, (including buildings, equipment, and vehicles) and human resources (including staffing and in-service training) (Chaulagai *et al.* 2001). In Bhutan, the routine service reporting also included monthly morbidity reporting, monthly mortality reporting, MCH/EPI/FP and nutrition reporting, and lab reports (Wilson *et al.* 2001).

Special programme reporting systems such as tuberculosis control, leprosy control, malaria control, maternal and child health and family planning, expanded programme on immunisation, and AIDS prevention are components (or subsystems) of HISs (Sapirie 2000:75) and aims at delivering information for special programmes.

PMTCT is one of special programmes reporting systems which are specific to maternal child health and aims at preventing the transmission of HIV from child to mother during antenatal, delivery and breast-feeding periods (see [www.avert.org](http://www.avert.org)). PMTCT requires facility-based information systems which provide information for the following functions (1) individual patient case management, (2) facility management, and (3) for HIV/AIDS control (WHO 2004). These HIS encompass programme management at district, national, and international levels, and involves programme monitoring, patient management, and patient monitoring.

Programme Monitoring is the routine tracking of priority information about a programme and its intended outcomes and the monitoring at the facility level requires many types of information, including aggregated patient data (*ibid*). Patient management is the one-to-one relationship between a provider and patient over time assisted by written records while patient monitoring is the practice of capturing the history of an individual patient over time and across clinical sites in which the patient history can be written down in any format or entered into a computer (WHO 2004:8). This also includes a system to follow patients when they are referred to special services or transfer from one facility to another.

Lippeveld (2001) argues that routine health information systems have the potential to play a major role in facilitating integration between individual health and public health interventions (Lippeveld 2001:13); since both individual health care services and public health functions are being carried out within the health services system, and the routine health unit based health information system is the main information source for both type of interventions. For

example, the routine health data which is recorded by the health staff within the facility while performing their regular daily health care activities, is also the most obvious way of collecting data for patient management (Lippeveld 2000) which is also the HIS for PMTCT.

The routine health information system and health system at large are related in the sense that the health information system (HIS) cannot exist by itself but is a functional entity within the framework of a comprehensive health system that offers integrated health services, including curative care, rehabilitative care, disease prevention, and health promotion services and hence making it a management information system (Lippeveld and Sauerborn 2000). Thus, routine health management information system can be defined as a system that provides specific information support to the decision-making process at each level of an organisation (Lippeveld 2001:15).

HIS, like every system, has an organised set of interrelating components that can be grouped under two entities: information process and HIS management structure (Lippeveld 2001:16). Through the information process, raw data (inputs) are transformed into information in a "usable" form for management decision making. The information process consists of the following components: data collection, data transmission, data processing, data analysis, and presentation of information for use in patient care and health services management decisions.

To make the information process efficient, a HIS management structure is required to ensure that resources are used in such a way that high-quality information is produced in a timely fashion. This structure can be broken down further into two components: (1) HIS resources and (2) a set of organisational rules. HIS resources include persons (e.g., planners, managers, statisticians, epidemiologists, and data collectors); hardware (e.g., registers, communication technology, and computers); software (e.g., carbon paper, report forms, data processing programmes); and financial resources. Organisational rules (e.g., the use of diagnostic and treatment standards, definition of staff responsibilities, supply management procedures, and computer maintenance procedures) ensure efficient use of health information system resources.

Sauerborn and Lippeveld (2000) argue that good management is a prerequisite for increasing the efficiency and effectiveness of health services. The World Health Organisation (WHO) has long identified HISs as critical for achieving for all by the year 2000 and explicitly links improved management to improved health information system (Mahler 1986 cited in

## *LITERATURE REVIEW AND THEORETICAL FRAMEWORK*

Sauerborn and Lippeveld 2000:1). Unfortunately, health information systems in most developing countries are inadequate in providing the needed management support and they are widely seen as management obstacle rather than tools (Sauerborn and Lippeveld 2000). The problems of HIS in developing countries includes duplication and waste among parallel information systems, poor quality of data, irrelevance of the data gathered, lack of timely reporting and feedback, and poor use of information (ibid).

Restructuring and revisions of health information systems in developing countries is typically donor driven and their influence impacts the performance of information systems operating in developing countries (Chilundo 2004). The donor driven programmes often have an independent decision-making structure and an internal system for information reporting and resource distribution. The result is several parallel and overlapping information flows, a lack of integrated analysis, and a high burden of registration on health workers in the primary health care facilities. The next two paragraphs provide examples from the literature.

Chilundo *et al.* (2004) explain how the specific information systems of three different health programmes were different. For example, the malaria programme had four reporting channels: the Weekly Epidemiological Bulletin, Malaria Programme reporting system, District/hospitals reporting system (sentinel malaria sites), and the laboratory system. Furthermore, all these different channels delivered information of varying quality (Chilundo *et al.* 2004). The variations between the programmes, as well as the varying levels of quality, posed difficulties to integration.

Braa et al (2005) provide another example of the fragmentation problem in Botswana where individual programmes had all developed their own vertical reporting structures supported by different donor-focus and funding. Given the uneven distribution of funding across the various programmes different HIS had different strength; EPI, PMTCT and ART had strong HIS with computers, staff, specific software and good routines where MCH had a relatively weak infrastructure (Braa *et al.* 2005).

The fragmentation problem hinders the performance of HIS, as it creates duplication of work and data, lack of information sharing, and poor quality of information. It also leads to poor use of information systems due to the multiplicity of channels (Sauerborn and Lippeveld 2000; Braa *et al.* 2005; Webster 1995; Chilundo 2004). To improve HISs, there is a need to address such fragmentation problems.



Lippeveld and Sapirie (2000) suggest 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”. Analysis of information systems should include identification of all actors with stakes in the health information systems reform and research on contextual political, socio-economic, and administrative factors likely to influence the outcome of the health information system reform (Lippeveld and Sapirie 2000:249). The next section presents the information infrastructure theory which provides one way of understanding the HIS and these wider issues simultaneously.

## **2.2 Information infrastructures (IIs)**

Hanseth (2002) advocates that information systems have to be seen as part of larger infrastructures, and this perspective comes with specific implications on how these infrastructures should be developed. As contrasted to information systems that typically refer to systems for a single area of use for a limited group of users, information infrastructures (II) denote large, complex, and networked systems that are associated with multiplicity of ownership and heterogeneity. Their evolution takes place gradually over time, they are distributed over geographical boundaries, and are supporting a number of users and use areas. Given this broad scope, II involves a large range of political, social, organisational and human issues, and encompasses use at industrial, national, regional (for example, EU), and even the global level (Hanseth and Monteiro 1998). Information infrastructures are described as the “next generation” of ISs, which have to be understood using a holistic perspective; it is more than the individual components.

Hanseth and Monteiro (1998) argue that information infrastructures are characterised by the following features which make them qualitatively different from other information systems; enabling, open, heterogeneous, evolving, shared, and socio-technical.

Infrastructures have a supporting or *enabling* function since they support a wide range of activities; they are not especially tailored to one. They open up a field of new activities, and do not just automate something existing. Infrastructures are *open*, in the sense that there are no limits for potential number of users or nodes in the network, or of technological components and application areas supported (Hanseth and Monteiro 1998:41). Being open does not necessarily imply the extreme position that absolutely everything is included in every

II, but to emphasise that there are no predefined limits to who might participate in the design and deployment and the development time has no beginning or ending.

Openness of information infrastructure implies *heterogeneity*: Infrastructures are *heterogeneous*. Heterogeneity can occur in several forms, for instance, when one standardised 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. Over time, what is considered to be separate or part of the same will change, and elements initially developed separately will be linked together; that is to say infrastructures have *evolving* characteristic. These evolving processes make infrastructures heterogeneous in the sense that they are composed of different kinds of components (technological components, humans, organisations, and institutions), and also inscribe different human interests and qualities, making the IIs as *socio-technical* systems.

Information infrastructures can be seen to serve as a *shared* resource, as they support a larger set of activities within a larger community, and when one application is integrated with other through information exchange, they become mutually interdependent (Hanseth and Monteiro 1998:48). For example, an application may become integrated with another and the first application and its data becomes a shared resource. They are shared in the sense that integration with the new application will lead to sharing of some data originally used by the first application and hence making the original application and its data a shared resource. They are also shared from the perspective of use, since the same infrastructure will be used by a collection of users and user groups, and one or all the objects can be used by one or all of them (although it may appear differently to the different users). Infrastructures are transparent in use, in the sense that it does not have to be reinvented each time or assembled for each task, but they invisibly support those tasks.

After having discussed the key characteristics of IIs (enabling, open, heterogeneous, evolving, shared, and socio-technical), I elaborate on two key concepts of installed base and cultivation, which respectively help to understand and improve IIs.

Installed base is a key concept drawn from II theory that helps to understand that IIs does not grow *de novo*; but it wrestles with the “inertia of the installed base” (Hanseth and Monteiro 1998:48) and inherits strengths and limitations from that base. The new version must be developed in a way making the old and the new linked together and “interoperable” in one

way or in this way the old - the installed base - heavily influence how the new can be designed and in fact how it can evolve. The focus on infrastructure as “installed base” implies that infrastructures are considered as always already existing, they are never developed from scratch (Hanseth and Monteiro 1998:47). When “designing” a “new” infrastructure, it will always be integrated into or replacing a part of a later one.

To manage the complexities of information infrastructure, the cultivation concept is preferred to the concept of construction as a metaphor. Hanseth and Monteiro (1998) argue that cultivation characterises a fundamentally different approach to shaping technology. They write:

*[When we] engage in cultivation, we interfere with support and control, a natural process. [When] we are doing construction, [we are] selecting, putting together, and arranging, a number of objects to form a system....* (Dahlbom and Janlert 1996 cited in Hanseth and Monteiro 1998: 156).

Cultivation captures quite nicely the role of both humans and technology, and provides a basis for developing strategies for infrastructure development (Ibid: 160). Rather than plan, prescribe and construct growth, cultivation seeks to strengthen and nurture growth, through constant care, continuous assessment and a commitment to revise strategies that do not work (Aanestad *et al.* 2005). In cultivation, the installed base is seen as an actor since it is involved in development activity, and more importantly plays a crucial role as mediator and coordinator between the independent non-technological actors and development activities. The installed base is not just an actor but a powerful one. Its future cannot be consciously designed, but designers do have influence - they might cultivate it. Below I will elaborate on how cultivation of the installed base can be conceptualised.

The stakeholders around the design and use of an information infrastructure include, at least, different categories of end-users, a collection of managers from involved user organisations, numerous vendors for various components of the infrastructure; regulatory regimes (often governmental), standardisation bodies with professional standardisation experts, and bureaucrats, telecom operators and service providers, political leaders and institutions (such as the European Union). Taken together, they rhetorically promote visions of desirable changes in the II (Ibid: 79).

The key actors involved in the cultivation of the installed base are designers (being active in the design and specification of standards), service providers implementing larger parts of the infrastructure and users. Infrastructures become self-reinforcing, and gain momentum, as they grow. Changing an infrastructure means building a new one in the sense that the new features also obtain their value from the size of their installed base. Hanseth (2002) sees the installed base to act as a designer itself because it acts as mediator and coordinator between the independent non-technological actors and development activities.

A feasible way to deal with scaling of information infrastructures, is for the information infrastructure to evolve in a small-step, near-continuous fashion respecting the inertia of the installed base (Grindley 1995; Hanseth, Monteiro and Hatling 1996; Inhumane and Star 1996; Star and Ruhleder 1996 cited in Hanseth and Monteiro 1998:163). Between each of these evolutionary steps, there has to be a transition strategy, a plan which outlines how to evolve from one stage to another.

Strategies to cultivate the installed base include modularisation, use of gateways and bootstrapping. Modularisation is an approach in which an entity is divided into smaller unit (modules) based on their use or user groups, in a way that allows the building of one upon the other. This approach is said to facilitate the flexibility of extending or improving infrastructures (Hanseth and Monteiro 1998). The different sub-networks, entities or modules can be interconnected using gateways which are standardised solutions to connect parts that have been separately developed, or that come from different sources. A gateway provides the means through which the previously incompatible parts can work together to satisfy the broader needs of the users (ibid: 209). Hanseth and Aanestad (2003) argue that bootstrapping is crucial for the development of all networks including social and technical ones; and they define it as “a process of making a tool by means of the tool itself” (Hanseth and Aanestad 2003: 386).

### **2.2.1 Conceptualisation of Health information infrastructure**

This section conceptualises the health information system in line with the information infrastructure perspective, emphasising the features of II described in the previous section: enabling, open, heterogeneous, evolving, shared, and socio-technical. In this section, I argue how HIS exhibit these infrastructural features, and are thus better understood as HII.

## *LITERATURE REVIEW AND THEORETICAL FRAMEWORK*

Health information systems are enabling and continuously evolving to serve both existing and new use areas. The underlying complexity and ever-changing nature of health systems makes it difficult to make predictions on pattern of patients and their sickness. The health system is subject to many changes, like the introduction and removal of programmes, for instance Marbug virus and bird flu.

Health information systems are open in the sense that there are no limits for the number of users, use or application areas, stakeholders or vendors involved in the design, and technological components. For example, if the bird flu disease is controlled, there will be no need to record data but if not, there will be much data to be collected.

Health information system is heterogeneous, since it includes a number of users such as planners, managers, statisticians, epidemiologists and the community. The information collected by the health staff at facilities are used at the district which prepares reports to be sent to the central level and also through their vertical and horizontal channels (Shrestha and Bodart 2000). The HIS is thus a shared by multiple users located in different locations. Work routines, organisational structures and social institutions are very significant elements of the installed base and this fact makes the installed base to be seen as a complex heterogeneous and socio-technical thing, since it includes human, organisational aspects and technological components.

All these features help us to argue that HIS can be effectively conceptualised using concepts of II and I thus conceptualise HIS as a HII.

However, Hanseth and Monteiro (1998) point out that there are different types of infrastructures, including global ones like the Internet and more specific ones like the Norwegian healthcare sector's information infrastructure. The two infrastructures may have different characteristics, and may have emerged and been developed in different ways. It is not necessary for an infrastructure to possess all characteristics of larger infrastructures like the Internet. Based on this argument, I propose that a national HIS can be regarded as an information infrastructure.

The primary reason for using information infrastructure theory is to elaborate the challenges related to the development of new or improved components of the health information system. What Information infrastructure theory says about the installed base, and how it limits and influences the expansion, becomes important when we consider the introduction of new

components, for instance, through integration. With this view on information systems, the improvements or introduction of new components should take into consideration how suggested new components will fit with the current system, as each new feature added to the installed base will need to fit into the existing structures at that moment.

I argue that conceptualising health information systems as health information infrastructure provides insights relevant also to the discussion of integration of information systems. This perspective emphasises that the installed base evolves through introduction of new components in order to improve, replace or extend the existing ones (Hanseth and Monteiro 1998). Furthermore, the conceptualisation of an information infrastructure being a shared resource implies that the some features or resources of installed base will be shared by the new infrastructure through integration (*ibid*). In this aspect it can be said that integration of information system is a focal point of II theory. The next section will discuss these issues in more detail.

### **2.3 Integration of Information systems**

Braa *et al.* (2005) describe lack of coordination and integration among numerous sub-systems where each health programme is running their own system. This is done with little regard as to how this is integrated with or beneficial to the overall HIS (Braa *et al.* 2005:5). In their assessment of the routine HIS in various developing countries, this fragmentation problem was found in all of them, leading to an excessive burden of data collection with multiple overlaps and mismatches between the various data.

Integration is generally seen as the way to overcome fragmentation, both with regard to HIS and for information systems in general. Integrating heterogeneous data sources is a fundamental problem in information and database management systems, and has been a topic of research over the last two decades (Mykkanen and Korpela cited in Chilundo 2004:46). In the following sections I will discuss research insights that I see as relevant to the issue of integration.

#### **2.3.1 Defining Integration of information systems**

In the most general sense, integration may be any bringing together of things and fragmentation may mean one part which has been broken into many pieces or separate parts.

For the purposes of this thesis we need to consider both organisational and technical understanding of the concept.

With respect to software, integration requires interconnection and interoperability. The term interoperability means that different programmes can read and write the same file formats and utilise the same network protocols, so that different products can work together to accomplish tasks. This makes standardisation a crucial feature of integration (Braa *et al.* 2005). However, integration is more than the technical sides; it often touches fundamental issues in the organisation concerned, including issues of ownership and whether people want to share their data (Grimson *et al.* 2000). Integration of multiple heterogeneous work processes is a common need or wish in many organisations. Often some of the systems to be integrated have large autonomy, a term which denotes the condition that an entity does not depend on anything else. Autonomy can be technical, so that sub-systems can function even if the other systems are not functioning, or different organisational units may have different degrees of autonomy in terms of financial and decision-making power (*ibid.*). The way systems, work processes and organisations are designed must in some way balance the need for central control (e.g. through integration) and local autonomy (Walsham 1993). This fundamental tension makes the term 'integration' a fundamental one also within organisational theory where one distinguishes between horizontal integration and vertical integration as different approaches to ownership and control. Horizontal integration describes an organisation where e.g. several small subsidiary companies cater for different market segments or geographical areas. In contrast, vertically integrated companies are united through a hierarchy. There is a common owner, and the individual members usually produce a different product or parts of the final product. Control is central for management to secure efficiency, while local autonomy is crucial for flexibility. This 'design dilemma' thus is general: how to design (or integrate) systems (or organisations) in a sensible way?

In software engineering, the three-tier (or three-layer) client-server architecture (Connolly *et al.* 1999) has become widely used, because it offers a way to address this need for balancing control and autonomy. Here the user interface (the presentation layer), the functional process layer ("business rules" or "logic"), the data storage and data access are developed and maintained as independent modules. These may run on separate platforms, and allow a large degree of flexibility, as any of the three tiers to be changed independently. I now discuss the scope of integration of information systems.

### 2.3.2 Scope of integration

The notion of integration of information system is ambiguous in the sense that different approaches and proposed solutions exist (Monteiro 2003: 430). Some of the central ones are message-based, middleware and data warehousing (Grimson *et al.* 2000: 52). In all these approaches the integration is solely focusing on technical principles; networks, protocols for communication, programming languages, database, and the like. We need to go beyond the technical vocabulary of IS and see how it is related to wider organisational issues as integration of information system is multifaceted because it does not involve only technical issues. Braa *et al.* (2005) also argue that ICT approaches to integration are nearly solely focusing on the technical level and to a large extent neglecting the social, organisational and political aspects of integration (Braa *et al.* 2005:31). The main parts of the literature are technically oriented, but in the following I will use the common terms in a more abstract sense. I will describe different approaches to integration of health care systems and services using these terminologies. The subsequent paragraphs will give brief description of instances of integration dimensions:

**The message-based approach:** A set of standard messages that allow different health care information systems to exchange messages carrying data is defined and in essence provides a communication between different systems (differences in platforms, programming languages and data models as well as differences in perspective (Monteiro 2003). Information can be exchanged for example through interface engines or database gateways that allow heterogeneous health information systems within a hospital or region to exchange information via standardised messages. (Grimson *et al.* 2000; Aanestad *et al.* 2005).

**Middleware approach:** In the middleware approach health care organisation is considered as a set of disparate users, performing diverse tasks, but all needing to rely on and share a common data set and using a common set of business services. Such common data and facilities should be accessible to applications through technological interconnection of distributed system by having central element in the system providing holistic infrastructure where all applications may be connected through standard interfaces (Grimson *et al.* 2000:51). Monteiro (2003) calls this dimension “Distribution” and says it can be achieved through an object –oriented extension of remote procedure calls (Monteiro 2003:430).



**Data warehousing** offers an alternative approach that allows the data from individual systems to be integrated and homogenised in a single repository (database) by replicating disparate data (Grimson *et al.* 2000:51). One example of data warehousing approach is Enterprise Application Integration, which may include patient data management, some clinical functions, pharmacy module which is material management, and for financing and investing modules which are employed in administration.

The list presented above illustrates different approaches to integration, where I attempted to go beyond a merely technical view. I will strengthen my argument for a broader conceptualisation of integration with a brief discussion of two case studies.

Aanestad *et al.* (2005) describe a situation where integration of IS did not involve only technical issue but was also politically charged activity where multiple, different and competing institutional influences needed to be aligned. Through their case study of HISP in Andhra Pradesh state in India, where the process of integrating Family Health Information Monitoring System (FHIMS) and routine HIS, involved deeply political processes of negotiation between multiple actors including HISP members, World Bank and health officials in the state (Aanestad *et al.* 2005).

Another case is the case study provided in Webster (1995), where integration of information for Ford Company and its trading partners was done through EDI (Electronic Data Interchange).

*EDI is only one of the applications served by the network, which handles all kinds of corporate data transfer within Ford and with its trading partners. EDI in Ford was developed and implemented expressly in order to **streamline business processes and eliminate inventory**. Ford of Europe therefore uses EDI principally for applications which transmit forecast information to suppliers on materials requirements and which provide detailed instructions to suppliers on the daily shipments of materials required (Webster 1995:34).*

However, the case study further pointed out that Ford had other motives behind integration of information; that is

*In developing a proprietary inter-organisational network, Ford had a **basic objective - to gain competitive advantage by locking its suppliers and customers into its systems,***

*and locking its competitors out of them. Indeed, the company wants this lock-in to restrict its suppliers' and dealers' ability to do business with other manufacturers or, at the very least, to inhibit their trading relationships with other companies (ibid).*

From these case studies it can be argued that integration of data does not involve only technical issues but also political, economical and issue of power and domination. Thus, integration of information is multi-faced, as it involves broader issues such as organisational, data, and technical related ones (Braa *et al.* 2005). These insights relating to the scope of integration will be a fundamental part of my theoretical framework. However, before explaining that I will also discuss the *degree* of integration.

### **2.3.3 Degree of integration**

There is not one widely shared taxonomy for integration techniques, but one suggestion is offered by Aanestad *et al.* (2005): a continuum between *loose* and *tight* forms for integration (Aanestad *et al.* 2005:11). Tight integration focuses on elimination of fragmented systems; through replacing various disparate systems with one comprehensive fully integrated system, for example, by using single database. Implementing an Enterprise Resource Planning (ERP) system would be a typical example of one system that is expected to cover all functionality previously contained in multiple systems (ibid).

Loose integration is a more conservative approach, since the fragmentation is not eliminated but attempts are made by finding a mechanism to access various data situated in the separate systems (Aanestad *et al.* 2005: 11). The loose form of integration can be achieved, for example, through supporting the integration of the user interfaces from dissimilar applications into a graphical user interface on the desktop (Grimson *et al.* 2000:54). Example of interface integration includes using traditional screen scraping tools that allow parallel display of several application interfaces on the same computer screen or using modern web techniques that allow for more customised integration within a single graphical user interface – the web browser.

While the tight form of integration requires the aligning of data formats, functionality, and business logics, looser forms of integration may specify standards that allow a certain heterogeneity 'behind the stage' (Aanestad *et al.* 2005: 11).

The key reason for the pressure towards tighter integration of information systems is the more general transformation in business organisations to streamline, interconnect and compress their value chain or their business processes and to resolve the problems of poorly coordinated and largely independent work processes (Monteiro 2003:429).

Grimson *et al.* (2000) suggest that tighter integration might be difficult to achieve due to the difference like software application and organisation practices within different organisational units. Monteiro (2003) also points out that the differences in autonomy between different health care units provides ambiguity in tight integration of information system (Monteiro 2003). Grimson *et al.* (2000) suggest that loose integration may be the preferred approach for system integration across the organisations and tighter integration for within the organisation (Grimson *et al.* 2000:53).

Following this, I now present my theoretical framework, which will be used to present the empirical work and analyse the challenges of integrating the HISs.

## **2.4 Theoretical framework for analysis**

The theoretical framework that I used in my study needed to address the fact that integration needs and approaches can vary both according to their scope and degree. I have relied on a framework spelled out by Braa *et al.* (2005). The authors point out that different professional groups associate different meaning to the term integration; IT professionals will associate technical integration, health professional may think about integrating data sets and indicators, and policy makers may think institutional/organisational integration. The authors suggest that these three levels are providing a useful framework for understanding integration (Braa *et al.* 2005:26).

**Software issues:** Often different software programmes are used in different subsystems of a HIS or in different vertical programmes (Braa *et al.* 2005).

**Data issues:** The content, meaning and logic aspects of data, indicators, and information may vary, and integration at the level of data and indicators is basically about standards and standardisation (Braa *et al.* 2005:29). Braa *et al.* (2005) give an example of PMTCT programme in Botswana where different terms and nomenclatures are used across the HIV programmes.

**Organisational issues:** The social, organisational, non-technical and end-user aspects may also vary. Often different HIS are developed for different programmes with no coordination; they move with their own staff, logistics (e.g. vehicles), computers and software (Braa *et al.* 2005).

However, I have expanded this framework and divided the organisational category into two: one category for people/work practice and one category for institution-level issues. I do this in order to distinguish between local, everyday work practices in the health facilities and the larger institutional realities that surround them (e.g. the health care structure and hierarchy). Below I will give examples from the literature for the two sub-categories I propose:

**People and practices related:** This involves work practices at the local level, for example related to data collection routines. For example, a study from Mozambique describes how health workers collected data for different programmes such as routine, malaria, and tuberculosis. The tuberculosis had better funding, separate personnel and consequently better data management in terms of quality than the malaria programme regardless that malaria was a leading killer disease (Chilundo and Aanestad 2004).

**Institutional related:** This involves coordination between different actors involved in the implementation of HMIS (Braa *et al.* 2005:5). An example of such situation is where donor funded systems has better quality than routine system due to availability of resources such as data collection materials (Braa *et al.* 2005; Chilundo 2004).

A HIS conceptualised as an information infrastructure is a large, socio-technical network which involves different actors with different interests that become involved in integration attempts. Therefore, integration of information systems involves broader issues including technical and social aspects, such as integrating software, data, work practices and institutional. These four aspects: software, data, work practices and institutional related will be used as an organising framework for the empirical material.

In this study the characteristics of installed base and cultivation are focused. HII have to wrestle with the inertia of the installed base comprising of data sets, reporting formats, software, society with prevailing diseases such as AIDS and with geographical mobility, and health programmes such as PMTCT, which are deeply embedded in the political, social and cultural context. This installed base challenges the process of integrating the HIS, which needs to be based on extensions and improvements to what already, exists rather than starting

from scratch. The cultivation approach provides an approach to deal with the challenges of the installed base. This approach acknowledges the presence and influence of the installed base, and suggests piecemeal and incremental change process. There are different approaches to apply the cultivation strategy; such as the use of gateways, installed base itself, and modularisation principles.

The principles discussed in the above paragraphs, will thus help me to theoretically conceptualise the HII, identify the challenges of integrating HIS, and also provide guidance on how to address these challenges. In the analysis and discussion chapter concepts of installed base and cultivation will be used as analytical tools for my empirical material. The concept of installed base will be used to understand the fragmentation problems observed in empirical work, while the concept of cultivation will be used to analyse and describe how to address these challenges.

## **2.5 Summary**

This Chapter has presented the literature review and the conceptual framework. The materials discussed in this chapter are comprised of three interconnected aspects: information system, information infrastructure, and integration of information systems. The literature showed that to understand information system a holistic approach is needed, that is health information system are health information infrastructure since they evolve over time and existing social-economic affects its expansion. In the next chapter, I present the study context and research approach that I followed to conduct the research.

## **Chapter 3**

### **STUDY CONTEXT AND RESEARCH APPROACH**

This chapter describes the research settings and the methodology used for data collection and analysis. This thesis is set in Tanzania. In Section 3.1, a brief background of Tanzania is presented by introducing the geography, demography, education, socio-economic profiles, health status problems and the organisation of the healthcare system. These aspects have a 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. This study was carried out using a case study research approach, with qualitative research methods. Section 3.2 describes the research approach used in this study by presenting research genesis and design in sections 3.2.1 and 3.2.2 respectively. Section 3.2.3 presents research methods, data analysis, validity and reliability of the research and ethical issues employed in this study. I also present the access and study limits in section 3.2.4. Section 3.3 presents the chapter summary.

#### **3.1 Study context**

The United Republic of Tanzania is made up of two countries: Tanganyika and Zanzibar. The Government of the United Republic of Tanzania has authority over all Union Matters in the United Republic, and also over all other matters concerning Mainland Tanzania. The Revolutionary Government of Zanzibar has authority in Zanzibar over all matters, which are not Union matters. Zanzibar has its own ministries, such as for education and health. The study took place in two districts in Tanzania Mainland; Ilala and Tabora Municipals which are located in two different regions: Dar Es Salaam and Tabora.

##### **3.1.1 Situation analysis of Tanzania**

The United Republic of Tanzania is the largest of the East African countries (i.e. Kenya, Uganda and Tanzania) with an estimated population of 36 million. It borders with Kenya and Uganda to the north; Rwanda, Burundi and Democratic Republic of Congo to the west; Zambia, Malawi and Mozambique to the south. On the east, it has a long coastline covered by the Indian Ocean which hosts Zanzibar and Pemba, and other offshore islands. The country has an area of approximately 945,000 square kilometres, including inland bodies of water.

The map below provides an idea of the location of Tanzania in relation to its neighbouring countries and overview of study districts.

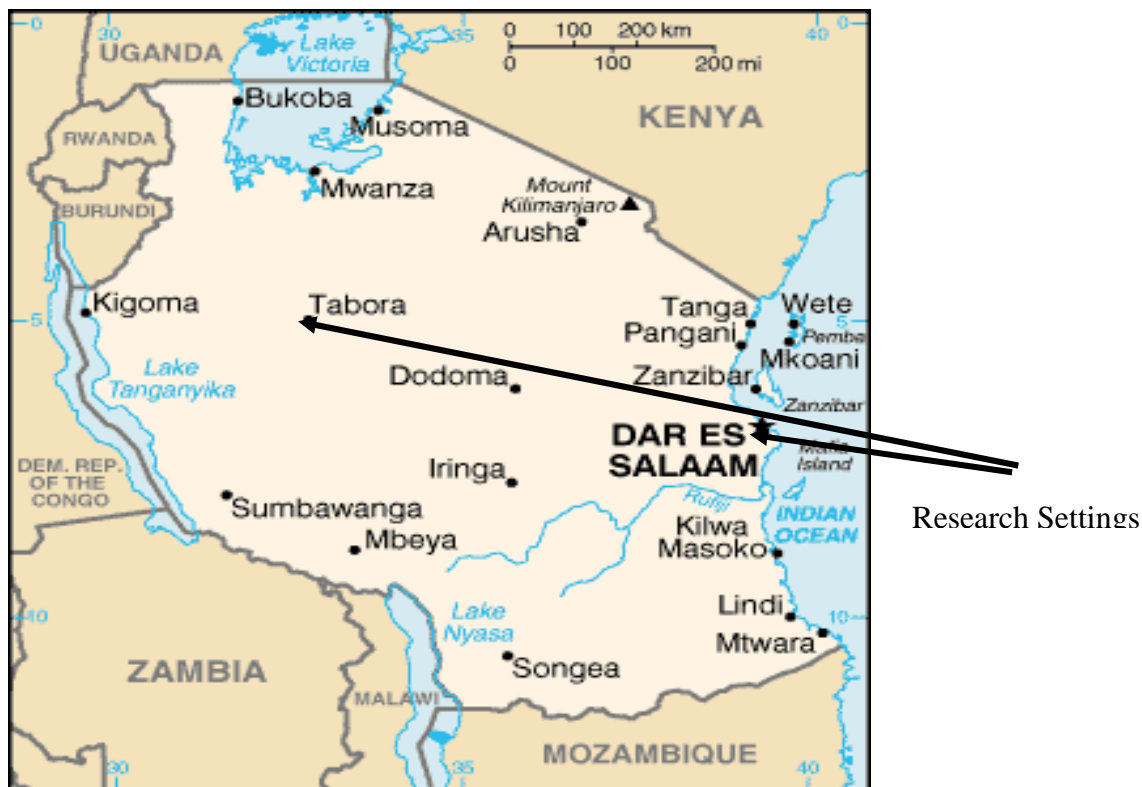


Figure 3.1: A map of Tanzania showing the geographical view and the study areas.

The country is administratively divided into twenty-six (26) regions: twenty one on the mainland and five in Zanzibar. Each region has many districts, which make up a total of one hundred and thirty administrative districts; the mainland has one hundred and twenty (120) and Zanzibar has ten (10) administrative districts. The country is connected by 81,900 Kms of roads, less than 5% of which are paved, thus making communication, including around health services, to be problematic, especially in the rural areas. The country has a population of approximately 34.4 million (2002 census) with a life expectancy of 42 years (for Males) and 44 years (for Females)

While primary education is compulsory in Tanzania, the school infrastructure does not have the capacity to enrol more than 50 percent of eligible children. However, as a result of adult education campaigns, more than 90 percent of people over the age of 15 are now literate. While in the early 1990s, most students attended government schools, now there is a trend for students to also attend private schools.

Tanzania is primarily a rural economy with agriculture, forestry, and fishing being the main sources of employment, involving a high percentage of the economically active population and contributing to 85 percent of the annual exports. The country is the world's largest producer of sisal and cloves. With per capita income estimated at \$110 a year, Tanzania is one of the world's poorest countries, with 50% of the population living below the poverty line, and heavily reliant on foreign aid, including in the health sector.

Tanzania faces health problems similarly to most developing countries. Major health problems in the country can be summarised as follows. The top ten diseases (morbidity) and health problems are malaria, Acute Respiratory Infection (ARI), pneumonia, intestinal worms, eye infections, diarrhoea, anaemia, skin infections, Sexually Transmitted Diseases (STDs) and Urinary Tract Infections (UTI). Other diseases are asthma, non-infectious gastrointestinal diseases and minor surgical conditions. There are also an increasing number of HIV/AIDS patients, which has resulted in the increase of Tuberculosis (TB) patients.

### **3.1.2 Organisation of health care in Tanzania**

Like in most other developing countries, the Ministry of Health in Tanzania is the highest authority in the health sector with overall responsibilities for health policy formulation, running health training institutions and manpower development. While the Ministry of Health is responsible for running the national consultant hospitals, specialist hospitals and regional designated hospitals, the Ministry of Regional Administration and Local Government (RALG) is responsible for running health centres, dispensaries and village posts. Primary health care is provided at the health facilities, including village health post, health centres, dispensary, laboratory, clinics and hospitals. The Government's referral system, recommended by health planners in 1993 (see [www.tanzania.go.tz](http://www.tanzania.go.tz)) reflect a pyramidal structure, as explained in the next paragraph.

The lowest level is the village health service which is responsible for providing preventive services, including in the homes. These services are available through the village health post, where there are two village health workers chosen by the village government and provided short training. The second level of the structure consists of dispensary services which cater for a population of 6,000 to 10,000 people, and supervise all the village health posts in its ward. At the third level, the health centre services cater for about 50,000 people, which is approximately the population of one administrative division. At the next level, the district



hospitals are responsible for the provision of health services in the district, either through government or NGOs (like religious organisations). At the next level we find the regional hospitals, which are expected to provide similar services like those at the district level, although with some additional specialists who are not available at the district hospitals. The Referral/Consultant hospital is the highest level of hospital services in the country. Presently, there are four referral hospitals: Muhimbili national hospital (eastern zone); Kilimanjaro christian medical centre (northern zone), Bugando hospital (western zone); and, Mbeya hospital (southern zone). Table 3.1 shows the distribution of health facilities in the country at these different levels in the year 2000.

Facility	Agency				
	Government	Parastatal	Voluntary/Religious	Private	Others
Consultancy/Specialised Hospitals	4	2	2	0	0
Regional Hospitals	17	0	0	0	0
District Hospitals	55	0	13	0	0
Other Hospitals	2	6	56	20	2
Health Centres	409	6	48	16	0
Dispensaries	2450	202	612	663	28
Specialised Clinics	75	0	4	22	0
Nursing Homes	0	0	0	6	0
Private Laboratories	18	3	9	184	0
Private X-Ray Units	5	3	2	16	1

Table 3.1: Table showing the distribution of health facilities in the country in the year 2000. The table depicts that most services are offered by health centres and dispensaries. (Source: [www.tanzania.go.tz/healthf.htm](http://www.tanzania.go.tz/healthf.htm)).

### **3.1.2.1 Mother and Child health care**

Some facilities, especially the dispensary and health centre levels, offer Reproductive and Child Health care (RCH) or Mother and Child Health care (MCH) as one service for healthcare. At district level, district hospitals are referral centres for women with complications regarding antenatal and family planning. The MCH section is one of the biggest sections in the facilities offering this service and it is further subdivided into subsections of family planning, children clinic, antenatal clinic, immunisation, sexually transmitted infection care, PMTCT, and delivery. However, not all facilities having MCH services offer the entire MCH healthcare services.

PMTCT care is conducted within the antenatal clinics and delivery facilities and is co-located in the same setting as other subsection of MCH. In some MCH facilities, antenatal clinic, PMTCT care and delivery services are all available. But in most MCH facilities offering PMTCT care there is no delivery facility, and one maternity ward in a facility can attend clients from different antenatal clinics. PMTCT care was offered by counselling, testing antenatal clients, and afterwards offering ART once to positive mothers and their children. Family planning was one of the key components of reproductive and child health and played a strong role in maternal, child and family health, and in prevention and control of HIV/AIDS. Family planning also includes activities for PMTCT, VCT and post-partum clients.

## **3.2 Research approach**

I now present the research approach used during this study by discussing the origin of the research, research design, and data collection methods. There is also a discussion of the ethical considerations used to conduct the research, and finally the limitations of the study are identified.

### **3.2.1 Research genesis**

This research is situated within the Health Information Systems Programme (HISP), a R&D programme involving various universities and Ministry/departments of health in different countries. HISP was initiated in 1994 by researchers from Norway in collaboration with the University of Western Cape and University of Cape Town as an action research HIS project in post-apartheid South Africa (Braa *et al.* 2003). HISP seeks to strengthen the HIS through efforts in three areas: the design, development and implementation of free and open source

software; training and support to field level health facilities; and, research and education through doctoral and Masters studies. After its initiation in South Africa, HISP has been also initiated in other countries including Mozambique, India, Ethiopia, Vietnam and Tanzania. A MOU (Memorandum Of Understanding) was signed between the University of Dar es Salaam (Tanzania) and University of Oslo in collaboration with the Ministry of Health on 5th July 2002 (Lungo 2003). This formed the contractual agreement for initiating the HISP programme in Tanzania. This study is a part of this programme and as a partial fulfilment for the degree of Master of Science in information systems, which is conducted by the University of Oslo. The study was financed by the Norwegian government through the quota programme which required the research to be conducted in the home country of the student within the domain of health informatics.

### **3.2.2 Research design**

The research aim was to analyse the challenges of integration of HIS both within and across particular HISs. While my thesis attempts to develop broader implications around the challenges and approaches of integrating HIS, the specific focus has been on the analysis of the routine HMIS (RHMIS) and the ISs related to the PMTCT programme.

The study followed a comparative case study design involving two districts of Tabora and Ilala where both the RHMIS and PMTCT HIS were studied. Case study research is an appropriate approach for bringing an understanding of a complex issue, which could be a programme event, an activity, a process, involving one or more individuals and using a variety of data collection procedures over sustained period of time (Cresswell 2003:15). 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).

Ilala district was chosen because of its social economic profile, it is in the busiest region (Dar es Salaam) in Tanzania; more cosmopolitan and has more social services being offered than other regions. Tabora municipal was chosen because of the ease of field access. This is the town where I grew up and attended my pre-University education which helped to provide deep understanding of the concept. A brief background of the two districts is now provided.

### **3.2.2.1 Tabora Municipal background**

This section provides a brief background of the Tabora Municipal. The study was conducted in Tabora Municipality, which is the headquarter of Tabora region, located in the western part of Tanzania, and comprises of six districts: Tabora Municipal, Tabora rural, Urambo, Igunga, Sikonge and Nzega. The history of Tabora town can be traced back to 1830 when it was called “Unyamwezi”. During the slave trade in mid 1840s, the Arabs constructed a base in the town. The name Tabora then emerged from the ethnic Nyamwezi (the largest tribe in the region) word “*MATOBOLWA*” meaning dried boiled sweet potatoes. Tabora Municipality borders Uyui district in the east, north and west and Sikonge district in the south, and is 800 kms west of Dar es salaam, 320 Kms east of Kigoma port on the shores of Lake Tanganyika, and 360 km south of Mwanza city. The climate of the district is generally hot (20 to 32 degrees), with relative humidity ranging from 25 to 65%, and the rain fall ranges from 650 to 850 mm per year.

The Municipality is projected to have a total population of 197,825 people according to the 2002 census and a growth rate of 2.36 annually; within the jurisdiction area of 1092.26 square kilometres. The literacy rate of the population in Tabora Municipality is 56% which has implications for health awareness. The Municipality is reasonably well connected through rail, roads and air services, although the main means of transportation is the railway. Even though the roads cover a fairly large percentage of the municipality, the condition of the roads has been deteriorating due to lack of funds for maintenance and the building of new roads, and this adversely impacts access to health care services.

In the municipality, agriculture is the main economic activity, focusing on maize, rice, groundnuts, beans, cowpeas, cassava, sweat potatoes and tobacco. Tabora is also famous for beekeeping (honey and beeswax) and forest timbering activities. Livestock farming is also an important economic activity in the region. Much of the arable land in Tabora Municipality has been degraded due to poor irrigation practices and an increasing demand for land for agriculture, grazing and firewood. The industrial sector employs about 8929 people, 13.5% of which are in the formal sector. There are various commercial activities varying in size and encompassing various retail activities such as groceries, stationery, hotel, bars, guesthouses, restaurants, cinema, pharmacies etc. Commercial activities are mainly concentrated in the central area, while the rural areas are largely poorly serviced. In summary, the low incomes of

the population, low productivity of land, and the existence of poor infrastructure influences the low health quality of the population and their access to health services.

Tabora acquired a Township council status in 1958 and was raised to municipal council July 1988. Administratively, the Municipality is subdivided into 21 wards; 8 rural and 13 urban. The urban wards are subdivided into 116 streets, while the rural wards are subdivided into 24 villages that are further subdivided into 117 hamlets.

The Municipal council has 9 departments: health, finance, economic planning and trade, education, agriculture, livestock and cooperatives, community development, works, town planning and environment, and administration and personnel. Municipality's economic base depends on the services sector provided by both central and local governments. Other economic activities in the Municipality are public services, commerce, small enterprises, industry, small-scale agriculture and forestry.

The Municipal Medical Office of Health is one of the departments of Tabora Municipal which is responsible for the provision of appropriate curative and preventive health services and promotion and management of environment health. Health care service in Tabora municipality is run as a multi-sectoral component involving the public, voluntary and private sectors. In Table 3.2 below, a distribution of the different health facilities by sectors is provided:

<b>Type of facility</b>	<b>Central Government</b>	<b>Municipal</b>	<b>Institutional</b>	<b>Private</b>	<b>Total</b>
Hospital	1	0	0	0	1
Health Centre	0	0	0	1	1
Dispensary	0	15	14	10	39
Total	1	15	14	11	41

Table 3.2: the distribution of health facility types and ownership at the Tabora Municipal.  
Source: Fieldwork, June 2004 to January 2005.

The mother and child healthcare services are provided in 22 health facilities located in different places and most of these are in public facilities. The private sector runs dispensaries, pharmacies and medical laboratories. There is no private or public hospital within the municipality; and the only hospital is the government regional hospital. The average distance for the residents to reach a dispensary is about 5 kilometres. Most of the health facilities are found in the centre of the town, and the 8 rural wards are not well accessed by the health facilities. There are limited funds received from the government, and the council's

independent funds are largely insufficient to provide a wide coverage to their services. The rural wards are also not well serviced by the private providers who, for economic reasons, prefer to operate in urban areas.

There is only one vehicle at the MMOH (Municipal Medical Office of Health) for supervision and coordination. The communication facility is poor, and the health workers from some facilities are often reliant on bicycles for movement, which adversely influence the timeliness of the health reports. Telephone services are available at the MMOH and regional Hospital, and the radio is also used at the municipal headquarters.

### **3.2.2.2 Ilala Municipal background**

This section provides a brief background for Ilala Municipal and a comparison between the two districts. Ilala Municipal council is one of the three local government authorities (the other two being Kinondoni and Temeke) in Dar es Salaam region which is located in the eastern part of Tanzania. Ilala Municipal is bordered by the Indian Ocean to the east, the coastal region to the west, Kinondoni municipality to the north and Temeke municipality to the south. Climatic conditions, including temperature, rainfall and humidity are quite similar to Tabora with the difference being Ilala experiencing two periods of rainy seasons. The land is almost flat, with the highest point being 900ft above sea level. The Ilala Municipality covers an area of 210km<sup>2</sup> with an estimated population of 667, 730 as per 2002-projected census of 8% growth rate. The literacy rate of the population is 84.3%, which compared to Tabora is 56%. In general, the road infrastructure is in a better condition than that Tabora, and 70% of all roads are well maintained.

Agricultural activities carried out in the Municipal have minimal contribution in relation to the actual food requirements of the population. In 1996/1997: production of food reached up to 21,746 tons, while the demand was 211,700 tons. In 1998/1999: production reached 25150 tons while demand was 247,081 tons. According to the 1999 data, the district is estimated to keep the following stock: 4600 cows, 3000 small ruminates, 120, 000 broilers, and 230,000 layers producing 1800 tray of eggs. This stock meets about 60% of the total demand.

As compared to Tabora, the level of industrialisation is higher in Ilala with a large number of industries being medium and small scale. Medium size industries are mainly those processing beverages, light drinks and pharmaceuticals. Between 1980 and 1990, the production of some

of the industries was very low and some of them were shut down. However, after privatisation some of the industries have started to increase their production.

The services sector is also more developed and formalised in Ilala, with businesses like insurance, banking, travel, clearing and forwarding, hotels and printing being well established. The district has a 10km strip of coastline conducive for fishing. Fishing is one of the key activities for Ilala residents and there are about 360 fishing vessels docking at Ilala along beaches.

The contribution of economic activities in the Ilala Municipal to the health sector is that most of the people could afford to pay for drugs and other cost-sharing health services in the health facilities. This collected money from cost sharing in turn could be used by the health system to buy health delivery stationeries and other equipments.

For administrative purposes the municipality is divided into 3 divisions, 22 wards and 9 villages. The Ilala Municipal council has 9 departments including health; MMOH (Municipal Medical Office of Health). The MMOH provides similar preventive, curative and promotion health services like Tabora, operated through a multi-sectoral network of public, voluntary and private sectors. The break up of the health facilities across these different sectors is summarised in Table 3.3 below:

<b>Type of facility</b>	<b>Government</b>	<b>Private</b>	<b>Total</b>
Hospital	1	7	8
Health Centre	2	12	14
Dispensary	13	111	124
Special Clinics	1	22	23
<b>Total</b>	<b>17</b>	<b>152</b>	<b>169</b>

Table 3.3: The distribution of health facility types and ownership at the Ilala Municipality.

Source: Fieldwork June 2004 to January 2005

Ilala Municipal runs 54 MCH units located in different places and 17 of these are in public facilities. Even though there are many MCH in non-public ownership but the patient density is higher in public ones. There are 8 vehicles at the MMOH office for supervision and coordination. All private hospitals have ambulance facilities and other vehicles, and 90% of private dispensaries are located within urban and semi-urban areas where public transport is available. This is in contrast to the Tabora Municipality, where public transport is still at the infancy level.

Some facilities at the Ilala municipal (both private and public ones) had computers. For example, Mnazi Mmoja and Buguruni health centres were found to have both computers and printers, though used primarily for secretarial and administrative purposes (using Microsoft Word and Microsoft Excel). In the two private facilities visited, computers were also being used for accounting purposes. In Tabora Municipal, none of the facilities visited had a computer or printer or photocopying machine. Telephone services are available at the MMOH, Hospitals, Health centres and 3 dispensaries. Unlike in the Tabora Municipality, internet services are available from MMOH to some NGO's and other Government/ Private Hospitals.

Transport is a very important resource to make supervision and resource distribution, such as data collection tools, in order to be available on time when and where they are needed. It can be seen that the Ilala Municipal is more advantaged than Tabora Municipal in terms of number of cars and better conditions of roads. It is also far better in terms of communication due to the availability of telephone/computers in some health facilities and also internet at the Medical office. I now present the fieldwork process employed in the two districts.

### **3.2.2.3 Research process**

This section presents the fieldwork process and research design. This research has its inception phase in August 2003, when my Masters course started at the University of Oslo, Norway, and subsequently had its second phase at the University of Eduardo Mondlane, Mozambique. Through the courses, I developed background knowledge about theories of information systems, HISs and how to conduct research. In Mozambique, we (the students) also visited health facilities in two provinces (Gaza and Inhambane) and learned about health information management settings.

In the second semester, I got an introduction letter from the University of Oslo (see appendix A.1) which was supposed to be used to gain entry to the field in Tanzania. This letter introduced who I am and what I wanted to do and was presented to the Ministry of Health in Tanzania. The permission was granted by receiving an introduction letter which also detailed the districts to be visited (see appendix A.2).

The letter from the Ministry was presented to both districts, and I had to select facilities to be studied (11 for Ilala and 8 for Tabora). The following criteria were used to select the facilities in the two districts:



1. Nature of facilities – This was the most important criterion; all facilities visited in the two districts needed to be RCH healthcare services.
2. The termed “better quality facilities”- The initial focus of this study was on how HIS can be improved specifically related to data quality. I asked district officials for facilities which were doing well in data management, according to the municipality perspective. The official pointed the ones that were thought to be of good quality and suggested also to study one rural facility which was perceived to be doing badly. The aim was to understand why data quality was poor there and what improvements could be introduced.
3. Ownership – some facilities belonged to the public sector while others belonged to the private sector. Facilities from both private and public sectors were considered to get a broader perspective of the problem. This can be seen in some regions, for example in Ilala, there were more private owned facilities than public ones. However, most facilities studies were public ones, since they are more disadvantaged than private ones in terms of limited healthcare services, due to inadequate drugs, funds, medical materials, workload of personnel and attending to more patients than in private ones (higher patient density).

Letters to staff in-charge of these facilities were written by the DMO offices in the districts introducing me, and the theme of my study (see examples of letters in appendices A.3 and A.4). Every letter had the official stamp of the municipality. The fieldwork was conducted by visiting the facilities, introducing myself to the staff in-charge and showing the letters to prove that I have the endorsement of the municipal. I also left copies of the introduction letter from the municipal with them. The signature and note was written by the facilities managers, on the letter which told the staff in-charge of the different MCHs section to give their support and cooperation.

In both districts, I ended up studying fewer facilities than planned (7 out of 11 in Ilala Municipal and 5 out of 8 in Tabora Municipal) due to research focus shift, as explained in the next paragraph. In summary, the facilities selected and subsequently visited in the two districts are summarised in the Table 3.4 below:

District	Total number of facilities	Public	Private	Facilities studied	
				Public	Private
Ilala Municipal	167	23	132	5	2
Tabora Municipal	41	16	25	4	1

Table 3.4: Facilities visited during the first phase

The initial focus of this study was related to improvement of data quality in the health facilities. Silverman (2001) argues that one of the strengths of qualitative research is its ability to shift focus as interesting new data become available (Silverman 2001:68). The focus of the study changed after encountering PMTCT services in the Tabora Municipal where the assessment of data quality of the HIS at the facility level revealed significant fragmentation problems. The focus shifted to the assessment of HIS in regard to fragmentation/the integration of existing HIS with new component. The initial study (and interview guide) thus served as a background and introduction for the PMTCT study, rather than as the final data gathering tool.

The process of revising the facilities had to be conducted again by seeking permission from the municipal medical offices of health in the districts and developing interview guide (see appendix B2). Some facilities not included in the first visit had to be added in the list. In one district the process of acquiring letter for extra facilities had to be done (see example of letter in appendix A.5). In the second phase, I visited all the facilities which I had access to between 2<sup>nd</sup> November 2004 and 18<sup>th</sup> January 2005. In summary, the facilities selected and subsequently visited in the two districts are summarised in Table 3.5 below

District	Total number of public facilities offering PMTCT services	Facilities studied
Ilala Municipal	5	4
Tabora Municipal	4	4

Table 3.5: Facilities visited during the second phase

This fieldwork was also conducted by making frequent visits to the Municipal medical health offices while studying the database system and also by entering data in the database. I had to revisit some facilities after learning about antenatal number flexibility and Tabora DMO

office to clarify some issues encountered during the facilities visits. The regional health office in Tabora was also visited. As a whole, the field research was conducted between 1 July 2004 and 18 January 2005 and the stay in the facilities took between 2 and 4 and ½ hours. The data collection phase ended on 18<sup>th</sup> January 2005.

### **3.2.3 Research methods**

Research methods represent the means for achieving the goals of the researchers. Qualitative research has the following characteristics (Cresswell 2003:181): emergent, interpretative since the researcher makes the interpretation of empirical data and the interpretation is shaped by his/her specific socio-political and historical moments. Qualitative research takes place in natural settings (home, workplace of the participants etc) and employs multiple methods that are interactive and humanistic, such as open-ended observations and interviews, document analysis, sounds, emails, scrapbooks (ibid). It extends through self-reflection and introspection (the process of carefully examining your own feeling, thoughts, and ideas) (Denzin and Lincoln 1994:2).

Quantitative methods provide comparisons and statistical aggregation of data and typically are characterised by the use of closed questions (*yes* or *no* answers) or *a set of predefined* answers, which can be quantifiable, comparable and measurable to provide results. However, Silverman (2000) mentions that, “Quantitative research methods can amount to a ‘quick fix,’ involving little or no contact with people or field, and also statistical correlations may be based upon ‘variables’ that, in the context of naturally occurring interaction, are arbitrarily defined” (Silverman 2000:7). Qualitative research was used as a basis for the case study, in which the challenges of integration were studied. Qualitative approach was favoured, since the research was concerned with exploring people’s everyday behaviour (Silverman 2001) around the HIS.

This method was also preferred due to its emergent characteristic (Cresswell 2003), given that I had little pre-knowledge about the health sector and health informatics. I could thus use this method and gradually increase my understanding over time.

This supposition turned out to be true. In the first phase, I concentrated on data quality improvements and encountered the PMTCT in Tabora Municipal. Due to the flexibility of the qualitative approach, in the second phase I concentrated on the PMTCT programme and identified some problems which I would have never discovered with predefined or rigid

methods like survey. The most important example of the problems I discovered was about the identification of antenatal clinic clients during the first phase. Without focusing on the PMTCT it would have been impossible for me to know that the identification of ANC clients had flaws and posed one obstacle for integration between RHMIS and PMTCT ISs.

I also found different computer databases in both study areas. The plan had been to study the regional database, but in Ilala there was no regional database and in Tabora, the database had been corrupted for one year.

### **3.2.3.1 Sources of information**

The empirical findings were obtained through a combination of qualitative techniques; interviews, document analysis/review, experimenting with the computer system, informal discussion with health workers at the district level and participation in the workshop. Cresswell (2003) argues that qualitative research is inherently multi-method in focus, as it attempts to secure an in-depth understanding of the phenomenon in question and enhances the reliability of the study (Cresswell 2003:181). The following methods were used:

#### **3.2.3.1.1 Interviews**

I conducted a number of interviews during this study (see appendix B.4 for details: district, date, facility and interviewees) including open ended ones where the respondent was asked a series of pre-established questions, without imposing any priori categorisation that may limit the field of inquiry (Fontana and Frey 1994:366). The interviews were conducted in the offices of the staff, for example in the facility manager or subsections of the MCH offices. Three times, I conducted group interviews; this happened when I started to interview a staff at the PMTCT section or at the district, and later colleagues (working in the same section) joined the interview. However, in most cases, the interviews were conducted with individuals. Informal discussions supplemented the interviews in case there was a need for clarification of some issues.

The main respondents in the first phase were facility managers and staff working for MCH subsections, and in the second phase, respondents were staff working in the antenatal care, PMTCT rooms, family planning, and maternity wards. Facility managers were interviewed since they are responsible for supervision and coordination of all matters in the facilities including data management. I even learned during the research that the facility managers in

Ilala and Tabora had attended the data management training and also engaged in directly or indirectly in the preparation of reports and data management in general at the facilities. I did not use tape recorders as the informants were not very comfortable with that, especially regarding PMTCT. I prepared some questions which related to the improvement of HIS and PMTCT in order to have consistency in asking questions (See appendices B.1 and B.2). The questions were in English but interviews were conducted in Kiswahili language, which is most widely used and understood in Tanzania. However, the notes were recorded in English language because of the need to write the field notes and thesis in English. The handwritten English notes were later typed up in greater detail.

### **3.2.3.1.2 Document analysis:**

This refers to the analysis of a number of texts and documents for different purposes such as studying organisation history, past activities and future plans. Hodder (1994) states that written documents and records are of importance for qualitative research because of its access, low cost and the information provided may differ from and may not be, or available in spoken form (Hodder 1994:393).

This approach was used to examine different documents used in the health facilities such as general data collection tools (cards, registers, and forms), monthly/quarterly/annually reports, facility folders reports of RHMIS and PMTCT, and information presentation (tables, graphs prepared, population figures displayed on the walls of the offices and any document which was relevant to me, like the municipal comprehensive health plans and letters from the Ministry. Electronic documents in Microsoft word and Excel format, such as the EPI data files, health records consisting of quarterly and annual data were also analysed for the purposing evaluating the quality of data management at the DMOs (District Medical Office).

The method was also useful to analyse the integration of HISs between different units of MCH; through analysis of different data collection tools. During the interviews the emphasis was on data gathering, recording and practices, together with evaluation of data quality of data collection tools and routines (completeness, correctness, consistency, etc.) at the facilities visited. For further assessment of HIS to determine fragmentation problems, I relied on the document analysis of data collection tools (such as for ANC register, ANC PMTCT register, Maternity Ward register) in addition to the background information gained through the interviews

Whenever there was consent from facilities health workers, I took some of the documents such as used patient cards and forms and photocopied some of them, so that I could analyse in detail later. For the same purpose, I used the digital camera to take several pictures of printed materials, pictures displayed on the wall or registers. However, document analysis had confidentiality restrictions; I was not allowed to view some data in the registers, since it contained information of individuals. Another constraint was the unavailability of photocopying facilities nearby for some facilities.

### **3.2.3.1.3 Experimenting with the system**

This method was used to study the district database in the two municipalities. To study the database, I entered data from the paper reports sent by facilities. I also interviewed users to get their views about the database system being used (Nielsen 1993). The interviews (see appendix B.3 for interview guide used during the experimentation with the system) added further to my understandings of the system studied. For example, from the study done in Ilala, I did not know that the system could not print or save, or the problem of reports being too general. My informants at Tabora municipal showed me some screens and said there were no print/save facilities in all the generalised reports. I had to review the database system again and concluded that the print/save facilities existed only in few of the reports (and not in all as some of my informants had told me during interviews).

I spent quite a time at the health offices at the district levels while experimenting with the database system. These visits gave me deep understanding of how activities were carried out, and it also gained me access to some other documents/written materials. Also, it gave me opportunity to conduct semi-structured interviews and informal discussions with my informants when they were not busy. Since I was available all the times, and could know the time my informants were available or not busy, I could meet them without prior appointment. The same opportunities were used to contradict or support understandings of my data obtained during studying the system, through discussions with the different health officials.

### **3.2.3.1.4 Participation in the workshop**

The opportunity of visiting the district office many times gave me the chance of having access to different kinds of information. For example, I learned that there was a PMTCT advocacy workshop at the Ilala municipal which included many participants. Attending the workshop

gave me insights into many issues regarding the PMTCT logistics and management in the city and the whole country in general.

### **3.2.3.1.5 Empirical data analysis and interpretation**

The process of data analysis involves making sense out of text and image data by developing an understanding of the phenomenon (Creswell 2003:190). In this study, data analysis followed these four steps:

1. Recording of notes during interviews, informal discussion, while experimenting with the system, and document analysis and later transcribed as field notes;
2. Re-organisation of my field notes comparing the data obtained from the four methods, and trying to develop its overall meaning, at the end of each day;
3. Categorisation the data into four aspects of integration; software, data, work practices, and institutional related; and,
4. Comparison of differences across the two systems RHMIS and PMTCT, and related these findings with theoretical concepts of information infrastructure including installed base and cultivation.

### **3.2.4 Data reliability**

In a positivist sense, “validity means truth: interpreted as the extent to which account accurately represents the social phenomena to which it refers” (Hammersley, 1990:57 cited in Silverman 2001:232). In my study, which adopted broadly a qualitative perspective, I was more concerned with the aspect of “Reliability (which) 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 1992a:67 cited in Silverman 2001:225). In ensuring the reliability of my data the following strategies were employed:

- Data were collected through multiple sources such as document analysis, open-ended interviews, experimenting with the system, and participation in the workshop. Usually the interviews went hand in hand with document analysis. For example, the study of the database system was done by combining system testing, and interviews.
- Provision of thick and detailed descriptions of the findings to try and give the reader a shared experience of the field.

- I spent prolonged times in the field; for example I frequently visited the same municipal offices and met the same respondents more than once.
- Whenever notes were transcribed, they were discussed with the participants so as to get their opinions on my data. For example, I discussed my findings with the informants at the district level. Also, this was done in the PMTCT study where there were different views about PMTCT clients whether male couples can be tested or not, about the second test, and also about recording data on the administration of the Nevirapine syrup on the mother card. Getting multiple views on the same issue helped to ascertain the reliability of my data.

### **3.2.5 Ethical issues in data collection**

Ethical issues were maintained during the fieldwork, for example, through gaining written permission prior to the fieldwork from both the Ministry and the districts and prior to conducting interviews. Other considerations included the following:

- Privacy of participants was respected. Thus, whenever the participant refused to be photographed, or give their names (but only official titles) or said I should not photograph some material, I obeyed. For example, in one facility, I was not allowed to photograph some displays on the wall as they thought that the wall was too disorganised. In some PMTCT health facilities, I was not allowed to analyse the local registers showing the name of the clients as I was coming from the town, I respected this wish. I respected the organisational settings, like doing interviews only at appropriate times. For instance, one day at one hospital an interviewee had to attend a meeting, and I waited for the interview to be conducted after the meeting.
- I erased the columns regarding client names and HIV results in all PMTCT pictures provided.
- In one district, I had to present my research proposal and left a softcopy of it to the district officials so as to enable them to be aware of and understand the study purpose.
- I rarely mention the name of facilities in order to protect my informants.
- Names of participating staff are not mentioned anywhere in my presentation



### **3.2.6 Access and study limits**

Apart from the limitations mentioned in the research process and methods sections, (for example, the restriction to view or photocopy some PMTCT documents) the following were some of the other limitations encountered during this study:

- The selection of facilities had to be done prior to the fieldwork, when the focus shifted to PMTCT facilities; it was not easy to get extra letters to other facilities.
- The PMTCT study was done in public facilities only, and there were private research coordinated by Harvard and Muhimbili universities in some facilities which I did not get access to.
- The district database studied had just been installed (August 2004). The health workers had little exposure to it; much of the presented findings on the software were based on my own analysis.
- The interviews conducted in the maternity ward were not useful since the places were very busy. I went three times to one maternity ward but the situation was the same; I spent little time in the wards. The place also had a psychological impact to me as I was myself in an antenatal period. I have thus little data from maternity wards and more data from the antenatal section, while PMTCT care was provided in both places. Thus, I talk more about antenatal clinics rather than of the delivery wards.

### **3.3 Summary**

In this chapter, I have presented the context of the research, research approach, the design and data collection methods and analysis process for identifying and addressing the challenges of integrating HIS in developing countries more generally, and in the PMTCT and RHMIS in particular. Qualitative research was employed in a comparative case study involving two districts in the two regions. The case studies are described in the next two chapters.

## **Chapter 4**

# **RHMIS (ROUTINE HEALTH MANAGEMENT INFORMATION SYSTEM) CASE STUDY**

I now present the case studies drawing upon the studies of the RHMIS and PMTCT HIS in the two districts of Tabora and Ilala. The case study of the RHMIS (or MTUHA in its Kiswahili acronyms) is presented in this chapter, and that of the PMTCT in the following chapter. I start by providing a background of the Tanzanian HMIS in Section 4.1, which is then followed by the RHMIS in Section 4.2, based on the studies of both the districts as there were little differences in the structure, functioning, and the challenges experienced. Given the focus of the thesis on understanding the challenges and approaches to integration, I draw upon the four-element categorisation of integration (software, data, work practices, and institutional related) as an organising framework (refer to section 2.4) to describe the two cases. This then provides the basis to develop the theoretical analysis in chapter 6 based on the concepts of installed base (to understand theoretically the nature of the integration problem) and cultivation (to understand how to try and address these challenges in order to improve the HII). Lastly, Section 4.3 summarises the fragmentation problems observed in this case study.

### ***4.1 Background of the HMIS in Tanzania***

Health information system in Tanzania can be traced back to 1989, when the evaluation of the then existing paper-based system was done. In 1996, the MOH started to implement the HMIS in various health facilities with the aim to provide uniform report formats that could be used for making standardised analysis (Rubona 2001). By the end of 1997, the HMIS was implemented nationwide. At the regional and district levels, the system was initially computerised and all data sheets from the facilities and districts were entered into the computer. The restructuring process was funded by external donors; mainly the DANIDA (Danish International Development Agency) and others, like the World Bank (Rubona, 2001).

The data flow process starts at the facility level and the data collection tools include registers, ledgers, books, guideline manuals and forms. The data, depending on the health care services provision, is collected based on the level of facilities, for example, more data is collected in the health centres than in dispensaries, as more services are offered there. Table 4.1 below

**RHMIS (ROUTINE HEALTH MANAGEMENT INFORMATION SYSTEM) CASE STUDY**

summarises some of the routine data collection registers and forms and report books, which were used and prepared in the MCH services in both districts.

<b>Routine register book/Tally form number</b>	<b>Title</b>	<b>Functionality</b>
1	Guidelines manual (user manual)	A reference book for health workers, explaining how to collect and compile data.
2	Health facility monthly report book	A secondary book which contains monthly summaries that are transcribed from the primary books.
5	Outpatient (OPD) register	This register is supposed to record information for outpatient clients. However, In some facilities in the MCH there is a doctor who prescribes for all sick pregnant women and children under the age of five who come to the clinic. However, for some facilities this register would not be found at the MCH section since the cases are attended at the outpatient department.
6	Antenatal register	For monitoring pregnant mothers, from their first visit to the health facilities up to the last visit of their pregnancy.
7	Child register	For recording information about all of the children who come to a health facility. Including children who come as newborns, children who are transferred from other facilities, and children who registered during community outreach. The main function is to monitor all child immunisations until he or she reaches the age of five.
8	Family planning day-day book	For recording all family planning clients, including those who are continuing with the programme and new acceptors. The registers also keep track of the quantity of contraceptive supplied to customers.
10	report book	A secondary book which contains forms for preparing quarterly and annual reports in various areas such as inventory, health service (curative and preventive), finance, buildings, and human resources. However, some reports from this book apply to public facilities only.
12	Delivery register	Contains information both on mothers and their newborn babies.
F201	Child tally form	Capture children's attendance and to record the weight of children who come for measles immunisation.
F202	Immunisation and vitamin A tally form.	Records information on immunisation and vitamin A supplementation for children
F203	General tally form	Used to prepare summaries from different registers in diseases categories.
F204	Neonatal tetanus tally form	Used to monitor neonatal tetanus disease
<b>PMTCT antenatal register</b>	Register book	For recording information about pregnant women who has undergo HIV counselling and testing in the antenatal facilities.

<b>Routine register book/Tally form number</b>	<b>Title</b>	<b>Functionality</b>
<b>PMTCT delivery register</b>	Register book	Records information of PMTCT activities in the labour wards
<b>PMTCT monthly summary form</b>	Monthly reporting form	Used for reporting PMTCT cases in both antenatal and maternity centres from facilities to higher levels.

Table 4.1: Routine data collection tools of Mother and Child Health in Tanzania. Source: Fieldwork July 2005 to January 2005. The emboldened text are for new registers introduced during the research

Health facilities produce reports using the collected information on a quarterly and annual basis, and information flows upwards through the District Health Management Teams (DHMT) to the Ministry of Health (MOH). Districts obtain their raw data from the health facility reports, and compile them into quarterly and annual reports. The DHMT compiles the information of all facilities (hospitals, health centres, and dispensaries) in the district processing file, and passes the summary reports to the regional health management team, and the regional data summary is passed on to the central level.

However, Dar es salaam Municipalities in which Ilala is included normally passed the summary to the Ministry of Health, instead of the Dar es Salaam City Council. These Municipalities thus acted as regions because of their larger population and greater number of health facilities, as compared to other regions. For example, Tabora Municipality has an area of 1000km<sup>2</sup> and an estimated population of 197,825 and 41 health facilities, while Ilala municipal has an area of 210km<sup>2</sup> with as estimated population of 667, 730 and 169 health facilities.

Initially, the data processing and analysis at the regional and central levels were computerised and the lower levels had paper-based systems. The computerisation process was extended to the district level (including both the study districts), and this was followed by the development of another version of the database. Now the same system was being used from the national to the district levels. The initial computerisation process was supported by donors who provided funds directly to the software vendor (Lungo 2003:118) This attempt to control the flow of funds, as Kimaro and Nhampossa (2004) argue, contributed to the poor functioning HIS, including issues of errors, incomplete development, inflexibility and a hard-coded application (Kimaro and Nhampossa 2004). The Ministry was not able to solve most of

these system problems due to their inability to pay the vendor for correcting the errors, since the funds were controlled directly by the funders (ibid).

The MTUHA system software was designed by Exact, a software company situated in Dar Es Salaam, and had also developed the first system; regional database. The system was developed using Microsoft Access 97 and export files in the same format. Before using any module, the user had to log in and select the level of access. MTUHA has four Modules: data entry, import and export, conversion, and reporting. Data entry module was concerned with all entries and updating of data in a form format. Forms which could be entered were F002 (Facility inventory report), F004 (Facility quarterly report), F005 (Facility annual report), D001 (District staff report), D004 (District quarterly report), D005 (District annual report), and facility data. Import and export functions provided a means whereby data could be exchanged between different levels like the national and regional. Reports module was concerned with the generation of district reports using the quarterly and annually reported facility data. The following photos show the computer and facility reports management at one district.



Photo 4.1: Computer (left) and facility reports folders storage (right) at the Ilala Municipal. Source: Fieldwork, September 2004.

The introduction of MTUHA contributed to a change of information flow, as the data was supposed to be entered into the software at district level, and then sent to the Ministry, while in the past, the data flow would go from the district to the region and from there to the Ministry. The Ministry would then prepare the regional reports and then distribute them to the respective RMOs (Regional Medical Offices) in the whole country. The transmission was supposed to be done by exporting the data to diskettes, flash disks or CDs, which would then have to be sent back to the respective districts where they belonged.

The training was conducted by the HMIS staff from the Ministry, in Iringa region, and all the regions sent their representatives. The Ministry demanded that the region representatives should always be dealing directly with data management at regional level. The training was done using a training manual which had been prepared by an institute in Iringa region, funded by DANIDA (the financing information was written on the front page of the manual). The contents of the training manual dealt mainly with how to enter data in the system, creating reports and exporting data. At the training session, all participants were given an installation CD, so that they could do the installation in their places at any time.

## **4.2 RHMIS at the district level**

After providing a brief general overview of the HMIS situation in Tanzania, I present the case description of the RHMIS based on the empirical work carried out in the two districts. As discussed above, the case study is presented using the four categories under which integration is analysed.

### **4.2.1 Software related issues**

Various issues relating to the software which contributed to the fragmentation problem are now discussed.

#### **4.2.1.1 Lack of flexibility**

The software did not allow modifications of data elements to be reported, given that the system was hard coded; making it impossible to add data elements and facility types other than those pre-programmed. Some drugs which were not in use were still being reported in order to be compatible with the old system. Example of such old data includes chloroquine tablets, chloroquine injection, chloroquine syrup and reusable syringe. Also, there were exclusions of new drugs in the system like amodiaquine, fansider and diclopar.

The lack of flexibility contributed to the exclusion of registration and storage of various types of data in the system. In the drug system used at the time of study, the public facilities got the drug kits and system included spaces to report its information, such as the number of days the drugs were out of stock and what quantities of which drugs remained. From the discussion with health staff in the district and at facilities, I learned that in the future every public facility will order drugs according to the needs of the served community through the analysis of disease statistics trends. This implies that the facility/district should know the reports, and this

data would need to be obtained through other channels, since the quarterly reports excluded new drugs.

#### **4.2.1.2 Poor analysis of data**

The system did not allow effective analysis of data, because the facility level analysis was not possible. Also, some reports could not be created, and it was impossible to print or save some forms/reports generated by the system (e.g. some of standard and PHC (Primary Health Care) reports). In order to create any report, the user had to provide the year and district code in the following first screen:

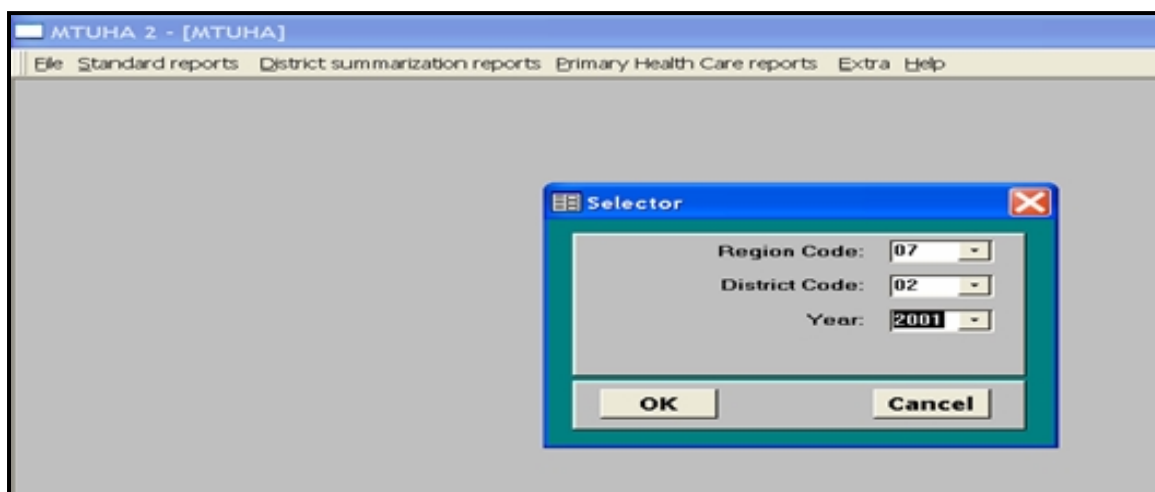


Figure 4.1: Report creation initial screen. Source: Fieldwork, September 2004

The district reports for certain years are depicted in figure 4.2.

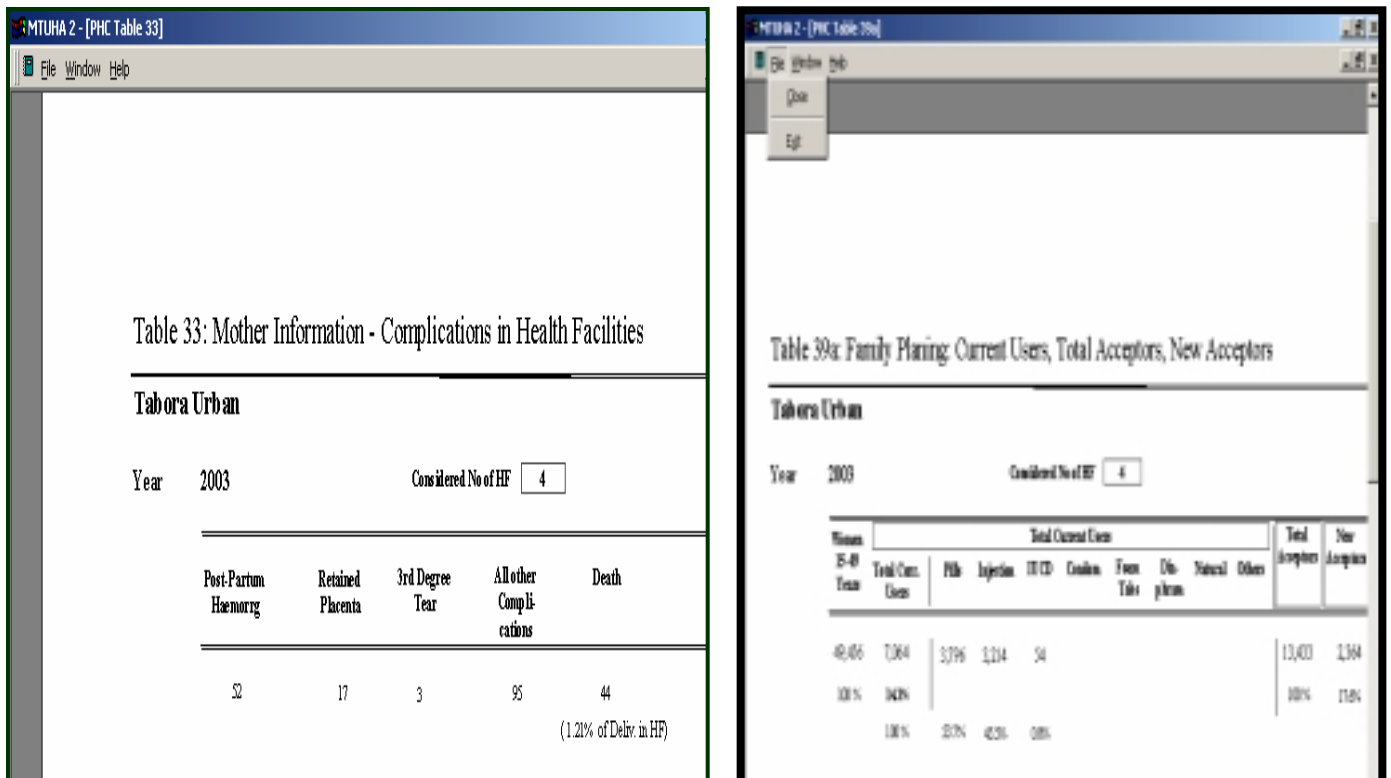


Figure 4.2: Examples of generalised reports from the computer system. Source: Fieldwork, November to December 2004.

These are examples of a generalised report (all reports were like this); giving reports for the districts with no facility details and for a single year. It is impossible to know from such report, which facilities had reported and which had contributed to what extent. The second column picture depicts the file menu with no print or save options (The window menu options dealt with arranging the documents on the screen).

Poor analysis of data was perceived to be an obstacle in data management. As one informant said,

*“This year we were told to prepare reports for past 5 years, another 10 years; it was very difficult. We spent a lot of time and we had to compile again”. Examples of such reports which are needed are Outpatient attendances for past 5 years. The current MTUHA system is impossible to create report in range of years as give all reports in a single year.”* (Information officer A, Fieldwork, September to December 2004)



Another informant said,

*“This system gives generalised reports (for the whole district) which are not good at all since when we allocate staff or any resource, we allocate to facilities. If we want to see which facility needs which staff, it is not possible because of generalised reports.”*

The same interviewee added:

*“When we were about to start PMTCT services, we selected facilities with highest antenatal flow by using the reports sent by the facilities. How can this system help us in such situation?”* (Information officer B, Fieldwork, September to December 2004)

Regarding the print and save difficulties, one informant had the following to say:

*“In most cases DMO or higher authorities wants a report or in hard copy, Even in planning, when you need figures it is impossible for all staff to come to the screen, what I do is take plain paper and copy figures”* (Information officer A, Fieldwork, September to December 2004)

The next diagram shows an example of further fragmentation of the information resulting from poor analysis of data such as those explained above; inability to analyse data facility wise, lack of printing/save and poor presentation. The folder was created in the last quarter of the year 2004 in one study district; after the system had been installed.

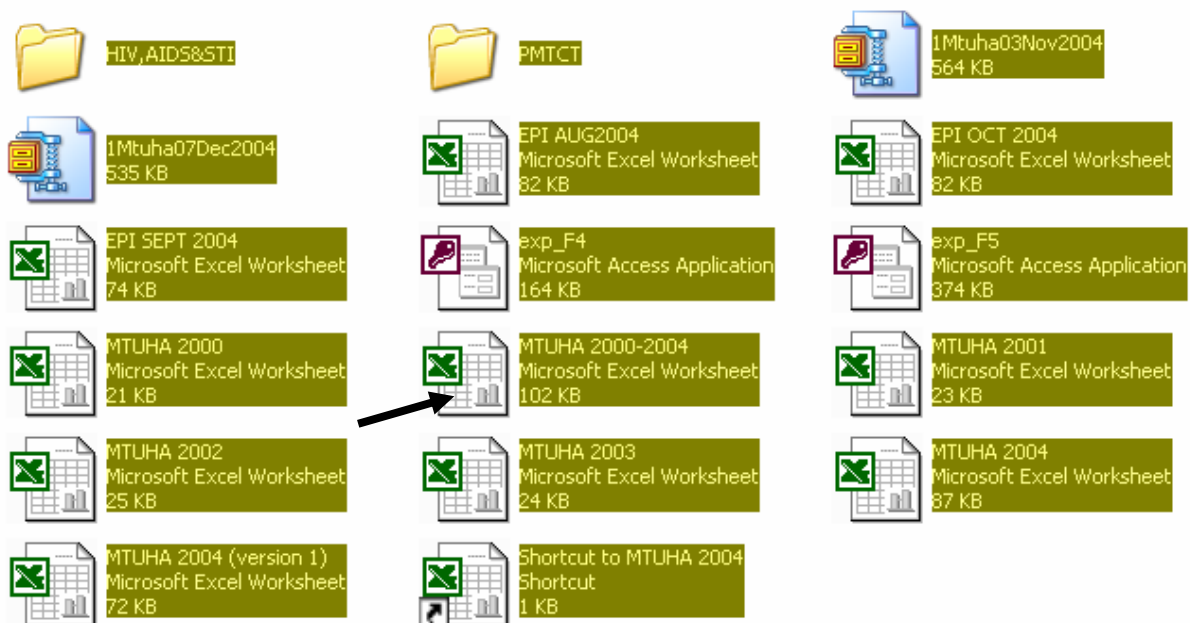


Figure 4.3: Folder found in one district depicting other ways of storing and analysing data. Source: Fieldwork, September to December 2004.

The folder shows how this information officer was trying to bring data from different sources into one place; there were folders for HIV, AIDS and STI, PMTCT, MTUHA and EPI. Some of the files contained data in the range of years, for example the one with an arrow. The data was taken from the manual district quarterly reports. The folder content also depicts how data was taken to Microsoft Excel for manipulation, since Excel is flexible.

#### **4.2.1.3 Non-functioning features**

The system had some components which were either partially functioning or not functioning at all. Examples are:

- Form F002 was partially functioning, as it was impossible to add new equipment;
- Help system was not functioning;
- Reports for calculating the reporting rate, health facility quarterly attendance, curative and annual data, health facility annual data for maternity special services, quarterly report for community outreach (community activity data and statistics), annual report for resource management (structural and equipment data), health facility data quarterly report (attendance, curative statistics and preventive statistics) and annual data (maternity data, maternity statistics, laboratory data and special service data) were not working.
- Missing forms in the system: F001, F003, and F008.

The partial functioning of the software lead to dependence on other means such as manual system and electronic files (in Microsoft word and Microsoft excel formats); hence leading to fragmentation. Regarding this problem, an informant stated the following:

*“The system is always brought here after finishing the development. Even when reviewing, the review is conducted at the national level. When we complain about the shortcomings of the system, the Ministry replies that it is very expensive to make programmes. If I were young, I would study how to make computer programmes as I hear that people who are making MTUHA programmes gets a lot of money. For example in the training at Iringa the participant questioned about the data elements concerning chloroquine that why should it be in the system, the trainers replied it is the programme.”* (Health officer A, Fieldwork, September to December 2004)

The informal discussions with other district informants revealed a similar situation of not being involved in the system reviews.

#### **4.2.1.4 Different software systems:**

The district offices, apart from the MTUHA software system, had other systems for data management. Example was the use of Microsoft Excel to manage data for the programmes of Immunisation (EPI) and infectious diseases data. There were no sharing of data between these different electronic system, hence resulting in duplication of data and data collection work.

#### **4.2.2 Data related**

This section discusses various fragmentation problems relating to data which are caused by variations of standards/standardisation in the routine system; both in electronic and manual forms.

##### **4.2.2.1 Different age categories between EPI and MTUHA**

The immunisation data in the vaccination programme and MTUHA had different age categories, thus making impossible to share data at the district level. The difference in age categories resulted in a duplication of information flow of immunisation data which was done monthly through the Tanzania monthly facility report on EPI activities and the MTUHA quarterly reports. Quarterly reports focused on the number of children immunised who were less than one year old, while the EPI focused on all children who had been immunised within month's time. Figures 4.4 and 4.5 shows the spoken forms

<b>Chanjo za Watoto (kutoka Jedwali 44, 45.A)</b>	
	Idadi ya chanjo za BCG umri mwaka <1
	Idadi ya chanjo za DPT 1 umri mwaka <1
	Idadi ya chanjo za DPT 3 umri mwaka <1
	Idadi ya chanjo za Polio 3 umri mwaka <1
	Idadi ya chanjo za Surua umri mwaka <1
	Idadi ya watoto waliopimwa uzito wakati wanapata chanjo ya Surua
	Idadi ya watoto waliokuwa na uzito <60 wakati wanapata chanjo ya Surua

Figure 4.4: The quarterly reports (F004) with vaccination coverage for children aged less than one year. Source: Fieldwork, July to November 2004.

**TANZANIA MONTHLY HEALTH FACILITY REPORT ON EPI ACTIVITIES**

1. Identification      MAR      2004      AKAIBABA      207      1539     

Month      Year      H Facility      District      Target 0-11mo      WCHA      Pregnant Women

2. Timeliness of Reporting

3. Disease Surveillance

	Measles	Neonatal Tetanus	AFP Cases
3.1 Number of cases this month	0	0	0
3.2 Cumulative cases (since Jan 1st)	0	0	0
3.3 Number of deaths this month	0	0	0
3.4 Cumulative deaths (since Jan 1st)	0	0	0

3.5 Please indicate number of cases which have been reported to the District on this month:

Measles Cases \_\_\_\_\_      AFP Cases \_\_\_\_\_      NT Cases \_\_\_\_\_

4. Vaccination Coverage

	DPT-HB1	%	DPT-HB2	%	DPT-HB3	%	TT1	%	TT2+	%
4.1 Number immunized this month	218	81	194	86	196	87	304	100	229	79
4.2 Cumulative No. immunized children	597	93	537	87	482	78	732	101	690	74

	BCG	%	MEASLES	%	OPW	%	OPV1	%	OPV2	%	OPV3	%
4.3 Number immunized this month	45	14	184	89	18	6	218	71	174	56	176	57
4.4 Cumulative No. immunized children	156	23	539	91	79	12	597	97	537	87	482	78

4.5 Date of entry (DD/MM/YYYY)

Figure 4.5: the EPI form with vaccination coverage focusing on all cases attended in the facilities. Source: Fieldwork, July to November 2004.

#### 4.2.2.2 Difference in label instructions provided by the electronic and manual forms

The electronic facility quarterly report form (F004) had no explanation or questions of indicators as shown in Figure 4.5. The manual form had a good explanation for it. This meant that when using the electronic format, to get the explanation of the indicators, users had to consult the paper format. The result of this was a multiplicity of ways of accessing data for the same data set. Figure 4.6 shows the electronic form while the counter manual form is provided in appendix C.3.

Question	Numerator	Denominator	Indicator	Target	Threshold	Problem?
1.	595	67				<input type="checkbox"/>
2.	219	133				<input type="checkbox"/>
3.	197	219				<input type="checkbox"/>
4.	0	133				<input type="checkbox"/>
5.	134	133				<input type="checkbox"/>
6.	107	133				<input type="checkbox"/>
7.	108	133				<input type="checkbox"/>
8.	2	108				<input type="checkbox"/>
9.	673	2727				<input type="checkbox"/>

Figure 4.6: The e-form, showing indicators with no explanation. Source: Tabora Municipal, December 2004.

#### 4.2.2.3 Difference of fields

There was a difference in the fields between the quarterly and annual reports for the same data set in some forms. For example, the family planning data in the annual reports (F005, part 3c): the electronic form had fewer elements than in the manual form. The electronic part had three fields: pills, injection, loop while the paper form had eight fields: pills, injection, loop, condoms, natural, diaphragm and other methods acceptors. There existed facilities with data for the non-included fields in the electronic version for such activities. Figure 4.7 depicts the electronic form with only three family planning methods; the part is indicated by arrow.

Figure 4.7: Form depicting family planning fields in the electronic form. Source: Fieldwork, September to December 2004.

This difference contributed to multiple ways of accessing the same data; in the manual and electronic systems.

### **4.2.3 Work practices related**

This section discusses various fragmentation problems relating to everyday work practices around the information management (such as data gathering, reporting interval and flow) in different levels of the health sector.

#### **4.2.3.1 Different working practices for different programmes**

The vertical programmes such as malaria, Tuberculosis and AIDS had their own data collection tools and reporting channels. Tuberculosis data from facilities was sent to the District TB/Leprosy coordinator on a quarterly basis, but in the MTUHA system the facilities were reporting the tuberculosis data annually. Immunisation data was reported monthly using a form known as “Tanzania monthly report on EPI activities” and its data management was administered by MCH coordinators at the district level. The immunisation data were again reported in MTUHA quarterly reports and the district level and were administered by information officers. All of these vertical programmes were supported by international donors; for example WHO (World Health Organisation) supported EPI.

#### **4.2.3.2 Different instructions for entering data in the implementation of the district database**

The instructions for entering data in the new district database differed in the two districts. Ilala Municipal data was entered from the year 2000 through the instructions sent by the letter from the Ministry. In Tabora Municipal, the regional health office decided that data for all Tabora region districts would be entered from the year 2004. This means that there were different datasets in terms of the periodicity of the dataset in the two districts.

#### **4.2.3.3 Different means of data collection and accessing information**

There were other ways of collecting data such as supervision, and requesting certain data from some facilities to compliment data not accessible in MTUHA. One example of such a dataset was the top ten diseases list, for every facility which was required at district level, and was also to be used for public health education in primary schools. The examination of both the

district profile documents had tables for the top ten diseases for inpatient, outpatient and death (see appendices C.1 and C.2 on examples of such tables from the district profile). The diseases were reported in the facility annual reports which were prepared in the month of December. The districts used different approaches in accessing such data; revisiting the facilities or requesting reports from bigger facilities.

This reporting of diseases contributed to multiple data sources as other means were used to access and store data. For example, in facility folders there were manual reports containing these statistics and some facilities with computers prepared the reports in Microsoft Word.

#### **4.2.4 Institutional related**

This section presents fragmentation problems arising from institutional realities (e.g. social activities in the society) that surround information management in different levels of the health sector.

##### **4.2.4.1 Lack of flexibility and missing data**

Inflexibility of the computer system resulted in missing data for some activities. The subsequent paragraph will present two examples which show how fragmentation of data (manual and computer system) resulted from the inflexibility of the system.

In the district database, outpatient diagnosis was supposed to be reported by hospitals only. As a result, the database system was disabled for this part when the facilities were dispensary or health centres. During experimenting with the database system, I found examples of facilities with outpatient diagnosis data , for example, see Table 4.2.

<b>Facility</b>	<b>Year(s)</b>
Tabata NBC dispensary	2001, 2002
Majohe dispensary	2002
Town clinic dispensary	2003

Table 4.2: Example of facilities with outpatient diagnosis data

The next diagram provides an example of a report sent by a dispensary which had data that was supposed to be reported by hospitals only.

Sexually transmitted disease nyinginezo	2	18	III Defined Symptoms au hakuna Diagnosis	29	204
Urinary Tract Infections	63	258	Diagnoses nyinginezo	810	509
Pelvic Inflammatory Disease	0	84			
Anaemias	70	81			

**Sehemu 6: OPD Diagnoses (itatolewa ripoti kutoka hospitali tu)**  
Magonjwa ya kinywa na meno yanatokana na kundi la 'diagnoses nyinginezo'

Kutoka "Diarrhoeal Diseases"	Miaka <3	Miaka 3+
Bacterial Diarrhoeal Diseases		
Diarrhoeal Diseases nyinginezo		

Kliniki ya Kinywa na Meno	Miaka <3	Miaka 3+
Caries	5	7
Periodontal Diseases	0	0
Dental Diagnoses nyinginezo	0	0

Kutoka "Cardiovascular Diseases"	Miaka <3	Miaka 3+
Hypertension	0	51
Cardiovascular Diseases nyinginezo	0	0

Diagnoses maalum	Miaka <3	Miaka 3+
Clinical AIDS	0	0
Diabetes Mellitus	0	0
Thyroid Diseases	0	0
Non-infectious Skin Diseases	18	31
Vitamin A Deficiency/ Xerophthalmia	0	0
Non-infectious Eye Diseases (toa Vit A defc)	0	0
Peptic Ulcers	0	5
Rheumatoid na Joint Diseases	0	0

Figure 4.8: Example of form with data from a dispensary. Source: Fieldwork, September to December 2004.

The next form shows the electronic counterpart of the above form, which was disabled for the same data.

**Sehemu 6: OPD Diagnoses (Itatolewa ripoti kutoka hospitali tu)**

**Hakikisha**  
Ongeza rekodi?  
Yes No

Kutoka "Diarrhoeal Diseases"	Miaka <3	Miaka 5+
Bacterial Diarrhoeal Diseases		
Diarrhoeal Diseases nyinginezo		

Kliniki ya kinywa na meno	Miaka <3	Miaka 5+
Caries		
Periodontal Diseases		
Dental Diagnoses nyinginezo		

Diagnoses maalum	Miaka <3	Miaka 5+
Clinical AIDS		
Diabetes Mellitus		
Thyroid Diseases		
Non_infectious Skin Diseases		

Add Cancel Exit

Figure 4.9: The electronic version disabled for dispensaries. Source: Fieldwork, September to December 2004.



This resulted in missing data in the electronic system. When I asked one information officer about the data in the facility reports supposed to be reported by the hospitals, the response was as follows:

*“Once in X hospital, the diabetic section has so many patients with one doctor to attend them. Many patients left, because they had to wait for 8 hours or more. Remember when a client is waiting to test diabetic they are not allowed to eat; so they had to starve. The Municipal realised that there was a problem and solved it by distributing the services to other facilities. Five facilities were chosen (some of which were dispensaries) in order to reduce the congestion of patients at the X hospital.”*  
(Information officer B, Fieldwork, September to December 2004)

Also, the analysis of a number of reports from the private facilities which were dispensaries showed to have data; but in the system it was indicated that it would be reported by the hospital. My informants replied that this was caused partly by private dispensaries which feared to register as hospitals for tax consideration. Some private facilities had special clinics such as the ones for hypertension and diabetes, skin diseases, ear/nose/throat, and ultra sound, but did not want to be officially recognised as health centres or hospitals as this would result in them paying higher tax. Even sending correct MTUHA reports (they underreported) was a problem because it was thought that the government would know the type of health services provided by those private dispensaries, and the number of patients served, and this would contradict with the amount of the tax they actually paid.

The above examples show how the fragmentation of data occurred as a result of the design of computer system (with no flexibility), without considering other realities such as the dynamic state of the health system and private facilities with multiple interest in the health sector.

### **4.3 Summary**

This chapter presented the RHMIS in the two districts. The fragmentation of the information system was caused by the design of the database system (inflexible), un-standardised data between different storage systems, and lack of coordination with other social institutions. The study showed how dependence on other means of data collection emerged due to problems of data management system at the district level, and hence resulting in further fragmentation. This situation of different means of data collection should be taken account when thinking of

the integration of information systems. A Summary the key integration related challenges identified in the case study is provided in Table 4.3 below:

<b>Category</b>	<b>Challenge</b>
System related	<ul style="list-style-type: none"> <li>- Inflexible code</li> <li>- Poor reflection of data needs at the district level in the database system</li> <li>- Partial implementation of the database system</li> <li>- Different software systems between different programmes with no sharing of data</li> </ul>
Data related	<ul style="list-style-type: none"> <li>- Different data elements caused by age categories between EPI and MTUHA</li> <li>- Different labelling between manual and electronic parts</li> <li>- Different data fields in software and manual systems</li> </ul>
Work practices related	<ul style="list-style-type: none"> <li>- Different frequencies of reporting with no data sharing(for example, EPI and MTUHA)</li> <li>- Data flowing directly to the programme managers</li> <li>- Unequal implementation of the same computer system in different places</li> <li>- Different means of collecting and accessing information at the district level</li> </ul>
Institution related	<ul style="list-style-type: none"> <li>- Gap between design of the computer system and the health sector's dynamic need</li> <li>- Gap between design of the computer system and private facilities with different interest in the health sector</li> </ul>

Table 4.3: Summary of the integration challenges observed in the RHMIS

## **Chapter 5**

### **HIS FOR PMTCT PROGRAMME: CASE STUDY**

In this chapter, the case study concerning the IS supporting the new programme of Prevention of Mother to Child Transmission (PMTCT) of HIV is presented. The main objective of this chapter is to understand the challenges of integration within the PMTCT programme. The chapter starts by providing an introduction to the PMTCT programme in Tanzania in section 5.1, followed by presentation of the description of the 4 integration related challenges of software, data, work practices and institutional in Section 5.2. Lastly, I present the summary of this case study in section 5.3.

#### ***5.1 Background of the PMTCT programme in Tanzania***

The HIV disease is said to have started in 1981, and the first victims were found in the United States of America. In the beginning, the disease was perceived by society to be for some groups of people such as gays, marines and heroin users. With time, it was realised that anybody could be infected, including heterosexuals. At the time this research was conducted, it had been estimated that two millions of Tanzanians were living with HIV (source: Ilala Municipal advocacy workshop, 5<sup>th</sup> October 2004), a significant proportion of which were children under five years of age. Most of these children (95%) were infected by their mother, either during pregnancy, labour or breast-feeding. The total probability of infection from mother to child is about 50%. Protection of HIV infection from mother to child might be done by combating the above three ways of infection (source: Ilala Municipal advocacy workshop, 5<sup>th</sup> October 2004). This realisation of the sources of HIV infection has led to the introduction of new programme known as PMTCT whose objective is to allow mothers know their status about their children. This is done by preventing HIV infection from mothers to babies during delivery by giving antiretroviral drugs to positive mothers and syrups to the baby born.

In Tanzania, the PMTCT service was introduced in public facilities in July 2000 even though some research on this topic had been ongoing. The PMTCT started in referral hospitals: Muhimbili, KCMC (Kilimanjaro Christian Medical Centre), Bugando and Mbeya and one hospital in Bukoba (a region in which the disease was previously much prevalent). In 2002, after an evaluation by the Ministry of Health, attempts were made to scale up the programme in some regions like Bukoba, Mwanza, Tabora, Moshi, Iringa, Dar Es Salaam and Mtwara.

Now the programme has been implemented in almost all the regions, done in phases by starting in some districts and then going down vertically to some facilities, and then horizontally scaling up to other districts.

The PMTCT service is organised as a set of procedures where the main clients were pregnant women. When women attended antenatal clinics, education on how transmission of HIV occurs was provided to them. That would be followed by pre-test counselling for those interested in that service. After pre-test counselling, mothers interested and willing would be tested for HIV by a nurse trained in both counselling and testing. All specimens of clients would be tested at once, and mothers would be told to come for their results either later on the same day, a certain future date, or during their next antenatal visit. Post-test counselling would be conducted to the mothers when they collected their results. While counselling could be done to any member of the family who was accompanying the client, the testing was conducted only of the pregnant women, their partners and also the children born from positive mothers. The partners of pregnant women if willing were counselled and tested in these antenatal clinics. Other people were advised to visit the VCT (Voluntary Counselling Centres) found in some public and private facilities.

The testing algorithm involved in Tanzania consists of a rapid test (which gives results immediately) using Capillus reagent. If the result was negative, the clients would be informed orally, but the code on the antenatal card would record this information. If the test was positive, a second rapid test for confirmation would be conducted using the determine reagent. For a mother to be categorised as positive, both rapid tests should indicate positive. It was believed (Source: Ilala Municipal advocacy workshop, 5<sup>th</sup> October 2004) that the accuracy of 2 rapid tests was equal to that of the Elisa test (a popular reagent for testing HIV). If it happened the results were positive and negative in Cappilus and Determine reagents, the situation was classified as a “discordance” which was referred to a higher facility for Elisa test. A negative result also had the probability of being a false negative, obtained during a window period (first three month after the virus infection), and clients were advised to conduct a second test. The second test was supposed to be conducted three months after the first test.

Testing and counselling were conducted by trained nurses in the facilities. There was also a facility internal control for laboratory procedures; Laboratory technicians of facilities were supposed to monitor the process and see if specimen results were correct. External control

was also conducted by taking the 10<sup>th</sup> negative and positive specimens and sending it to the referral laboratories for confirmation. The entire testing procedure was supposed to be confidential, as mothers were often known to be worried about confidentiality and not so much because of the test status. Also, it was expected that the women would have the choice to decide to whom they wanted to inform the test results. The next photos show some activities performed by health workers in PMTCT sections. On the top row, the first picture shows a health worker testing blood samples of antenatal clinic in one health centre in Ilala Municipal, while the second one in the same row shows samples, (the first row is Capillus tested specimens and the second row is specimen tested by the Determine reagent for confirmation). The other two pictures on the bottom row show HIV education activity prior to testing at the Tabora Municipal.



Photo 5.1: pictures depicting PMTCT activities testing (top photos) and public health education (bottom photos). Source: Fieldwork at health facilities, November to December 2004.

Mothers found positive were given drugs (a single dose) which would be used during labour to prevent the infection. The drugs which were used in the PMTCT programme were not much different from other antiretroviral ones, the difference being that it was given only once

and for the prevention of infection. Two kinds of drugs were used: Nevirapine (NVPC) and Zivodune (AZN), and were administered in the 28<sup>th</sup> week of the pregnancy to account for the possibility of premature delivery. The drugs were supposed to be swallowed only when the real labour begins, something which mothers in their first pregnancy had to be educated about. The maternity ward nurses also had the antiretroviral drugs, and they would administer a second drug if the mother vomited within half an hour of swallowing the drugs while in labour. In maternity wards, mothers who were not tested in clinics were counselled and, if they agreed, were tested. Usually, the counselled mothers were the ones who were not in true labour, since it is not easy for a mother to even say “yes” or “no” during true labour. Nevirapine syrup was given to babies born to positive mothers within 72 hours of delivery. The babies were supposed to be tested for HIV when they reach the age of one and half years. HIV positive mothers were also taught about breast-feeding options in order to reduce the HIV infection during breast-feeding period. One month after delivery, positive mothers were supposed to go back to the PMTCT section and be referred to the family planning section.

## **5.2 Case study of the HIS for PMTCT**

After providing a brief overview of the HIV disease and PMTCT programme in general, I now present the case description of the HIS for PMTCT programme based on the empirical work carried out in the two districts as there were little differences in the structure, functioning, and the challenges experienced. Prior to presenting the challenges of integrating HIS, I now present the information process in the PMTCT section.

### **5.2.1 The Information process in the PMTCT**

The process of information generation started when the mother agreed to undergo testing. The register and mother clinic card were the commonly tools used in this process. All information about PMTCT activities like counselling, testing and drug management would be documented in the register. Mainly the information recorded was regarding the dates for counselling, testing, post counselling and for nevirapine dispensing, and HIV results. In order to test mothers, the client ID was needed to distinguish clients. The drugs were supposed to be given in the 28<sup>th</sup> week, thus making the gestation age important to be documented. HIV positive mothers were supposed to go back to PMTCT one month after delivery, thus there was recording of postnatal information. Mothers were advised on breast-feeding options, and the selected options were recorded.

On the mother clinic card, a code was written to show the activities done and if the client was tested, the code would indicate the HIV results. The code was used as a means of communication between PMTCT nurses by telling the activities undergone by the client. The written code was also used as a means of communication between the PMTCT section in antenatal clinics and maternity wards in the delivery facilities.

The code which showed activities undergone and the HIV status was the only information communicated between the antenatal clinics and delivery wards. For nevirapine drug management, the communication was done orally both at antenatal care and delivery ward, with nurses in the maternity wards asking the client if she had picked the drug from the antenatal clinic and if she had already swallowed it or the antenatal care asking mother if her or the baby had nevirapine drug/syrup before/after delivery. The oral information obtained from the client would be recorded in maternity/antenatal PMTCT registers.

The maternity wards used the mother card and a maternity PMTCT register to document information concerning the PMTCT health care services. The ledger book was also used for drug management (acquisition and dispensing of nevirapine drugs) in both maternity wards and antenatal clinics. The following photo shows the registers used in antenatal and maternity ward.

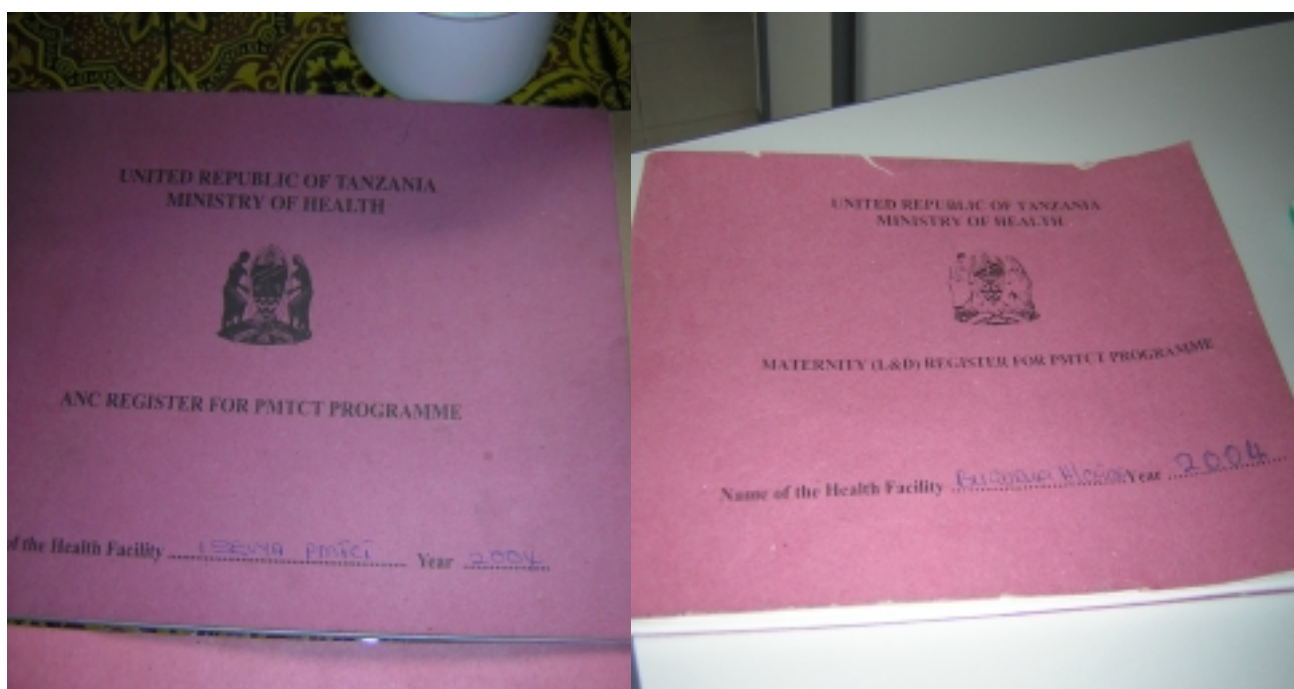


Photo 5.2: The ANC (Left) and Maternity (right) PMTCT registers. Source: Fieldwork at health facilities, November 2004 to December 2005.

The subsequent paragraphs present the data management activities found at the PMTCT centres. The findings are presented based on the four categorisations of integration discussed in section 2.4.

### **5.2.2 Software related**

Since there was no computerisation of the PMTCT except to some extent at the national level, I discuss the flow of manual information from the facility to the national level. At the end of the month at the facility (antenatal PMTCT clinics and Labour ward), data was compiled in summary forms (PMTCT ANC and Maternity monthly summary forms) and sent to the municipal (see appendix C.7 for ANC PMTCT summary form). Data was received by the district AIDS and MCH coordinators, and then forwarded to the region offices. The copies sent did not include the compiled data as the forms from the facility were sent as they are. In one Municipality, there was a plan to install the EPI info package to process the data. Also, improvised reports were found in some facilities like the one which was sent to the VCT. The region then forwarded the data to the national office. Feedback went from the national level to the region, to the district, and then to the health facility. At the national level, the system was computerised and the EPI info package was used to process data (see appendix C.9 for data entry form at the national level).

### **5.2.3 Data related**

This section presents the information management in the PMTCT centres as observed in the study. The PMTCT service first started without the use of any official registers. The section discusses various problems related to data management for PMTCT health care observed before and after the introduction of the official registers which resulted to data standards problem.

#### **5.2.3.1 Before the introduction of registers**

During the first encounter of PMTCT services in the Tabora Municipal, there was a register which was used to collect data. One form (known as ANC register for PMTCT) was used to collect data and another form (monthly summary form) was used for the reporting of the compiled figures to the Municipal. The register was used during training (for demonstration purposes) because there were no formal registers being used (see appendix C.4 for the unofficial register).



Regarding the data gathering, I observed that the registration numbers involving a three digit numerical code were used, starting with 001 and increasing in serial manner. When a new month started, the code would start again with the number 001. As a result, it was impossible to distinguish two clients with the same code in different months, and also between two clients with the same number from different facilities. There was a gap in the information collected because there was no place in the form to record the physical address (required for follow up), gestation age, second test, breast-feeding options and sex. Details of the gestation age were required to ascertain when the drugs should be given. Sex recording was important in order to document information for mothers and their partners. In the summary form, there was a place to report partner's information, but there was no tool for collecting such information. Some facilities mixed the two groups information making it impossible to differentiate between the mother and her partner. For example in one facility, I noted that a male had been tested, but by examining the register it was impossible to identify him as a male. Some health workers linked the mother and partner information by having a field which indicated the mother code in the partner tool. In other facilities, no link could be found between the client and the partner. PMTCT and ANC information could not be related since the registration number used in the PMTCT registration was different to those used in the antenatal section even though the clients came from antenatal section.

Regarding the filling of data, I observed that there was improper filling of the register in some facilities; there were different registering standards as some facilities used four characters while others used the required one. In the results column, a four character word UVWX was used where U meant counselled, V tested, W was results which could be X for negative or Y for positive, and Z indicated whether the client had undergone post test counselling. From the register instructions, this column was supposed to be filled with X or Y only to mean negative and positive results respectively. I found a lot of columns not filled in the registers. Some clients were pre-tested only and then quit the system. Others went to the extent of testing but did not come to pick the results. Also there was incompleteness which were caused by negative HIV clients; information regarding drugs management (Type of ARV given (nevirapine or AZN) and the date the ARV drugs given)

To summarise, the data management problems arose from the use of a weak identification system (of numbers), gaps in data collection, and improper register filling.

### **5.2.3.2 After the introduction of official registers**

The register was officially introduced in September 2004. In Ilala Municipal, the service started with official registers. I had the first contact with the registers in the Ilala municipal advocacy workshop. The new official register was different since some problems (e.g. missing columns) observed during the first visit were absent (see appendices C.5 and C.6 for inner pages of PMTCT registers). New columns were added in this registers such as gestation age and breast-feeding options. However, the register had no number, contrary to the MTUHA system, where all registers and forms had numbers (see photo 5.2 for the picture of the registers).

There was integration attempted between the antenatal clinic and PMTCT as now an antenatal number from mother cards/antenatal registers were used to identify clients and there was recording of the date client started ANC, gestation age and postnatal information for HIV positive clients. However, there was no integration between some tools like delivery register and PMTCT services. The delivery register was not integrated with antenatal information because of the impossibility of knowing which mother had been to which antenatal clinic. Also, the maternity services register and maternity PMTCT services registers were not integrated since the registration numbers used in the respective registers were different.

At the Tabora Municipality, there were some changes regarding data collection. For example, most clients enrolled in PMTCT service underwent all procedures (pre-counselled, testing and post counselled). The situation was different to the situation found in the first phase of the study, since very few mothers did not pick up their results. This resulted in fewer rows being left unfilled regarding HIV testing, results and post-tests counselled.

Tabora Municipal facility health workers had transcribed the data from the old register to the new one; in order to have data from the beginning of the PMTCT services. However, there was some incompleteness caused by differences in fields between the new and old registers.

There were still some problems in the new register. Still some columns were missing such as the one for the second test, and the sex/tool to register partners whose importance had been explained earlier. The need to collect sex data arose from the fact that some facilities mixed partner and mother information, as shown in photo 5.3 below.

REPUBLIC OF TANZANIA  
MINISTRY OF HEALTH  
ANC PMTCT Register

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Date Started ANC (dd/mm/yy)	ANC Card No. (add District if Referral or Regional Program) (XXX-YY-DIS)	Gest'n Age at ANC start	Date Pre-test Counseled (dd/mm/yy)	Date HIV Tested (dd/mm/yy)	Date Post-Test Counseled (dd/mm/yy)	HIV Test Result Circle: P, N  If not Confirmed P or N, Leave blank	Date Picked up NVP (dd/mm/yy)	If Mother for Post-Visit: Con w. L&F at Post-Nat  Mother took NVP
			√ if same date as start ANC (col. 1)					
23/11/04	058/04	Partner	23/11/04	23/11/04	23/11/04			
23/11/04	059/04	20/40	23/11/04	?				
23/11/04	275/04	20/40	23/11/04	23/11/04	23/11/04			
23/11/04	060/04	20/40	23/11/04	23/11/04	23/11/04			
23/11/04	276/04	22/40	23/11/04	23/11/04	23/11/04			
						P N		

Photo 5.3: A page on the PMTCT register, showing the male partner client, depicted by the dot. Source: Fieldwork at health facilities, December 2004.

The need to collect second test information arose from the fact that some facilities had second test clients, while in some others, the clients never came back for the second test. However, the turn out was low. Health workers interviewed said the low turn out could be caused by the habit of people coming late to antenatal clinics, as a result of which when the second test was to be conducted the client would no longer be pregnant. I was told that many women start to attend clinics after they thought they were pregnant by feeling the foetal movement. I could see the point of their argument through the examination of the registers. For example, at one facility I examined the register and found out that most women started antenatal clinics when the gestation period was over twenty weeks.

In one facility, there was a client who came for the second test after delivery, the gestation age was written as “post delivery”. Her information was mixed with that of the antenatal clients in the ANC PMTCT register. I further learned that even some VCT registered the second test as the first test. The following photo shows a page on the ANC register with ANC client who came for second test after the delivery. The picture also shows information of a male partner in the register, where the remarks column was used to mark that is the husband (depicted by a dot).

**UNITED REPUBLIC OF TANZANIA  
MINISTRY OF HEALTH  
ANC PMTCT Register**

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)		(10)	(11)
Date Started ANC	ANC Card No. (add District if Referral or Regional Program)	Gest'n Age at ANC start	Date Pre-test Counseled	Date HIV Tested	Date Post-Test Counseled	HIV Test Result Circle: P, N <i>If not Confirmed P or N, Leave blank</i>	Date Picked up NVP	If Mother is Seen for Post-Natal Visit: Confirm w. L&D or at Post-Natal Visit		Infant Feeding Choice (Circle choice)	Remarks
dd/mm/yy	(XXX-YR-DIS)		dd/mm/yy	dd/mm/yy	dd/mm/yy		dd/mm/yy	Mother took NVP	Infant took NVP W/72 hours	BF or RF	
			✓ If same date as start ANC (col. 1)								
08/11/04	118/04	12/40	08/11/04	08/11/04	08/11/04					BF	RF
08/11/04	106/04	20/40	08/11/04	08/11/04	08/11/04					BF	RF
08/11/04	265/04	24/40	08/11/04	08/11/04	08/11/04					BF	RF
08/11/04	266/04	16/40	08/11/04	08/11/04	08/11/04					BF	RF
1/11/04	050/04	20/40	08/11/04	08/11/04	08/11/04					BF	RF
1/11/04	07/04	20/40	11/11/04							BF	RF
1/11/04	268/04	20/40	11/11/04	11/11/04	11/11/04					BF	RF
1/11/04	055/04	20/40	11/11/04	11/11/04	11/11/04					BF	RF
1/11/04	269/04	22/40	11/11/04	11/11/04	11/11/04					BF	RF
1/11/04	118/04	16/40	11/11/04	11/11/04	11/11/04					BF	RF
1/11/04	117/04		11/11/04	11/11/04	11/11/04					BF	RF
1/11/04	058/04	P.B.	12/11/04	11/11/04	12/11/04					BF	RF
1/11/04	057/04	20/40	16/11/04	16/11/04	16/11/04					BF	RF
1/11/04	270/04	20/40	16/11/04	16/11/04	16/11/04					BF	RF
1/11/04	022/04	20/40	16/11/04	16/11/04	16/11/04					BF	RF

Photo 5.4: A page on the register, showing the client who came after post delivery for second test depicted by the dot. Source: Fieldwork at health facilities, December 2004.

In summary, the data problems identified after the introduction of the register were related to gaps in data collection caused by missing columns in the official registers and the lack of a tool to register data of male partners. The next section details how the health workers approached the problems by designing local tools.

### 5.2.2.3 Local tools found in the study

Due to the problems observed before and after the introduction of the official registers, health workers developed local tools using their own knowledge and needs. This section presents the local inventions found in the health facilities. The presentation is done by explaining the local tools used before and after the introduction of the official registers and the approaches used to register partner information.

### 5.2.2.3.1 Before the introduction of the registers

I observed improvised registers being used in all the facilities, and the health workers perceived them to be useful to their work. The health workers explained the reasons for using such registers as follows:

- The main idea was to distinguish clients since registration numbers used in the register corresponded to different months; so they needed client details to make the distinction of clients unique.
- To remove the gap in information collected such as breast-feeding options, gestation age, address, and sex/partner information which were needed for offering services (the importance of these information has been explained before). The register being used had no where to record such information.

I provide below a summary of the data being collected in facilities I visited before the introduction of the register:

	<b>Facility A</b>	<b>Facility B</b>	<b>Facility C</b>
<b>Columns</b>	Date	Date	Date
		Registration number	Registration number
	Name of client	Name of client	Name of client
	Age	Age	Age
		Antenatal number of client	
	Sex	Sex	Sex
	Gestation age		
	Address(street)	Street name	Village/street
			Breast-feeding option
	HIV results	HIV results	HIV results

Table 5.1: Data collected in the local registers in different facilities

The following photo shows the local register found in one facility before the introduction of the registers.



Photo 5.5: A local register found in one facility. Source: Fieldwork at health facilities, July 2004.

#### **5.2.2.3.2 After the introduction of the registers**

In both Ilala and Tabora Municipalities, a number of different local data collection tools were found to be used after the introduction of the official registers. There were two types of registers found in the second phase of the study: one containing personal information and the other for laboratory related activities (testing, and referrals made to higher facility levels for quality control). It was surprising for me to see, especially at the Tabora Municipal, that they would still be collecting personal information of clients while such information already existed in the antenatal register. The registers with personal information even had been improved by adjusting the data to be collected by adding/removing some columns. I identified the following reasons for the use of informal local registers (from different facilities):

- To distinguish clients, the antenatal number was used (more details in section 5.2.5.1), especially in giving the results. However, in practice, the antenatal number system could not be used for distinguishing clients.
- To record information of clients who were coming from outside the region (for example, those travelling) or clients from other facilities which did not have PMTCT services; since could not have their details.
- To remove gaps in missing tools, such as those to document partner information, laboratory activities and specimen referrals to higher facility.

The design of the antenatal register allowed the address to be recorded for a group of people coming from certain areas, such as a street of a designated ward. Without these local registers it would have been impossible to have the history of clients who were not residents of the facility (more details are provided in section 5.2.5.1). These local tools were thus perceived by health workers to be helpful in the future in making a follow up when needed. This was done by recording addresses of all clients enrolled in the service.

However, facilities collected the addresses differently in these local registers. Some facilities had detailed addresses which I perceived could actually locate a client in case of follow up as it included street name, house number, head of street or a nearby place. It was also perceived by the health workers that this type of detailed information register would be helpful in case of a follow up; for example, by providing to the herdsman the house number of client, who could then lead the nurse to the house location. However, in local registers, the house number and head of street name was filled up only for the positive clients. The name of the nearby place was also recorded in the mother card, but the disadvantage was that it was kept by the mother and was accessible only during the period when she attended the clinic. Some other facilities regardless of, the health workers argued, had the detailed addresses which could be used for follow up; I felt that this was not possible as the recorded address was very general, only including the street name or ward.

In Ilala Municipal, there were local registers and forms for laboratory procedures and quality control. This started in one facility and the municipal office copied this to the rest of the facility. These tools included a local form for laboratory check up, a register to record HIV and syphilis test results, and a quality assurance form for the 10<sup>th</sup> specimen. One laboratory form created contained detailed information in order to identify clients when giving the results

(see photo 5.7). Even though in the form there was an antenatal number, there was still the need to record initials and other details like gestation age, address, age, etc.

In the second phase of the research, wherein eight facilities were visited, I found personal and/or detailed personal information being collected either directly using a local register or indirectly using other tool such as laboratory forms. The following figures depict the use of such indirect tools such as improvised registers and a laboratory form:

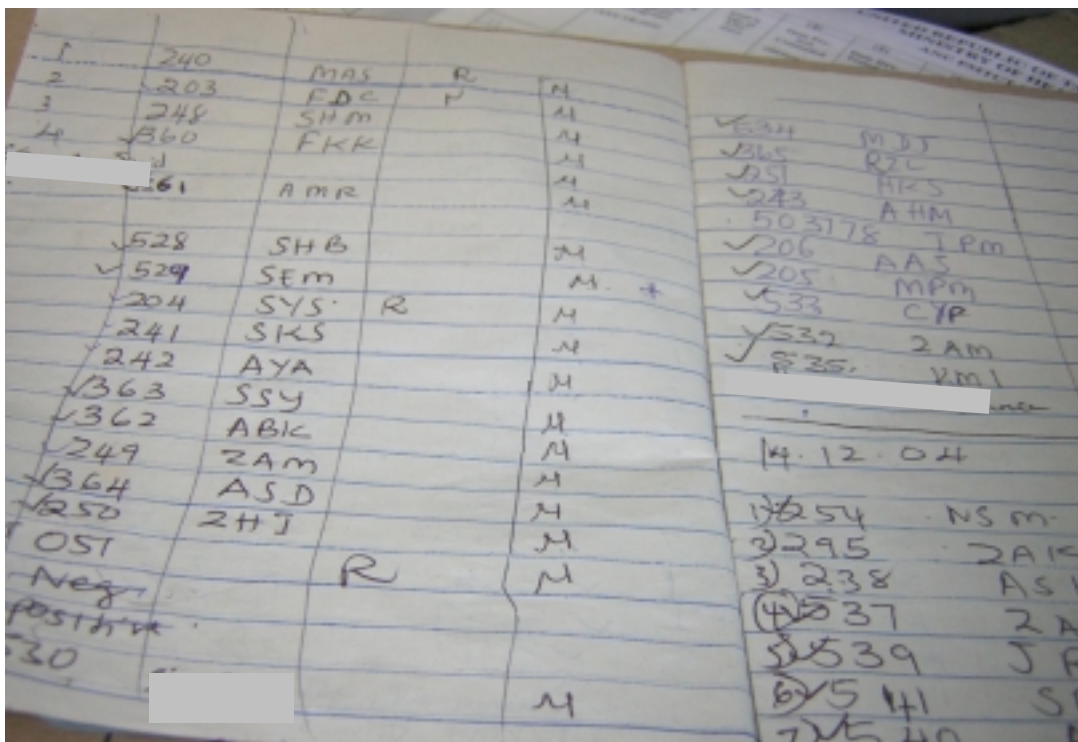


Photo 5.6: A local register with antenatal number and initial names used to assure that HIV results are given to the correct person. Source: Fieldwork at health facilities, November 2004 to January 2005.



Photo 5.7: Form used for each client with additional details being collected at the facilities to identify clients. Source: Fieldwork , Ilala Municipal, November 2004 to January 2005.

In one clinic, the provider used a local register to record detailed particulars of mothers, but the PMTCT supervisors insisted that the PMTCT and MTUHA registers were enough. The same message was encountered, when I attended a PMTCT advocacy workshop at the Ilala Municipal, where one health official stated the following:

*“In the future mother’s information will be obtained by combining ANC number in MTUHA and PMTCT registers”* (Health officer A, Ilala Municipal advocacy workshop, 5<sup>th</sup> October 2004)

### **5.2.2.3.3 Partner information management**

Since there was no tools to collect female clients ‘partner information, health workers at facilities approached the situation differently. At some facilities, the same ANC PMTCT register was used. However, the columns were specific for females, for instance the date the client started the ANC, gestation age, nevirapine dispensing, post natal information and breast-feeding options. When the client was a male, the gestation age column was filled “this

is partner” or left empty, and then in the remarks column it would be written “partner or husband” (see photos 5.3 and 5.4) This resulted in some of columns such as gestation age, breast-feeding options, date the nevirapine was picked up, etc to be left blank.

In other facilities, health workers perceived it to be inappropriate to mix the information, since some information like gestation age, Date client started ANC, date the nevirapine was picked up, etc. was inappropriate for males. Thus, a separate tool was created to manage such additional information of partners and different tools were used such as an outpatient register, a paper, an exercise book or an improvised printed register. However, in some registers there was no link between the mother and her partner information, and there was no possibility of knowing if a male was or not the partner of a particular client. The following figures depict examples of partner registers found in the study.



Photo 5.8: Information tools which include the folder with partner information. Source: Fieldwork at health facilities, January 2005.

Figure 3: Male Partner counseling register

Date	ANC Reg No. of Female Partner	HIV status of Female	Male Partner Pre-test Counseled (dd/mm/yy)	Male Partner HIV-tested (dd/mm/yy)	Male partner HIV Test P, N, U	Post-Test Counseled (dd/mm/yy)
17.11.04	186/04					
24.11.04	340/04		17.11.04	17.11.04		17.11.04
12.04			24.11.04	24.11.04		24.11.04
12.04	246/04		2.12.04	2.12.04		2.12.04
2.04	240/04		6.12.04	6.12.04		6.12.04
			17.12.04	17.12.04		17.12.04

Photo 5.9: Male partner register in one facility. Source: Fieldwork at health facilities, November 2004 to January 2005

However, by using both registers (prior and official registers), it was impossible to know that a client had abandoned the service. This could be reflected in the local registers (since there was personal information) but it was not part of the existing work practices because the service was not compulsory.

To summarise, there was data related fragmentation (different data standards in different registers) caused by the design of the registers before and after the introduction of the registers.

### 5.2.4 Work practices related

This section presents the daily work practice at PMTCT centres. The entire process of data registering and its communication was supposed to be confidential, which resulted in both negative and positive impacts. The positive side of it was the respect for a persons' privacy. The negative impacts ranged from the non-recording of information to the erasing of information, and ineffective communication among staff. These problems were compounded

by the lack of adequate human resources. Some of the problems identified are described below:

**Missing information:** Nevirapine syrup was given to children born from positive mothers to prevent infections from mother to child. However, this was not supposed to be recorded anywhere in the mother card for reasons of confidentiality. This was contrary to other immunisation given after birth to the new born. For example, the BCG and DPT immunisation which are also given after birth are recorded on the mother card or discharge summary form. Some facilities recorded nevirapine syrup on the mother card, while others followed the rule of not recording.

**Erasing information:** Some clients did not like recording the status in their cards. In two facilities I visited, the providers complained that some mothers have erased the part in which the HIV status had been written by using a rubber or scratching the paper. The providers learnt that when some mothers were alone, they had a tendency of showing to each other their cards. Some became curious about the code being different from the rest of the group, which resulted in some mothers erasing the code.

**Inadequate staff and associated work practices:** An acute shortage of staff and frequent job shifts as a result reduced the level of confidentiality. In some maternity wards, the situation was different to that in an antenatal clinic. In each maternity ward visited, only one or two staff had attended training, and they were supposed to train the others on the procedures and coding systems used. This was needed because of the system of shift work. Suppose in the labour ward, a mother was admitted at 8.00 am and the nurse on duty then left at 2.00 pm, another staff would take over and have to attend a client. Similar problems were also found in the antenatal centres due to staff sickness, change of stations and study leave. For example in both districts, some providers that I had met in the first research phase had moved to other facilities and others had been on study leave during the second phase of the study.

This was perceived by some PMTCT health workers to be one obstacle in data management and healthcare service in general. This was because some staff did not know the codes, and other PMTCT procedure, for example, that the clients were supposed to pick up the drugs in the 28<sup>th</sup> week. One provider had the following to say about staff shortage:

*“In this facility we have emergency delivery or mothers delivering at home and bringing their children here. You saw today Sister C is sick, soon am going to be on vacation which means our absence implies no care given in PMTCT. We two and the facility in-charge are the only one who knows about PMTCT codes. Suppose it happens that both of us are absent and there is emergency delivery or a child born at home whose mother is positive; no one knows the code which means no care will be given. If codes would be known the mother could be advised to take the child to the X hospital within 72 hours so that the baby will get Nevirapine syrup” (Nurse B, Fieldwork, November to December 2004)*

Another provider said:

*“I remember one day when all PMTCT staff were absent and I had to attend clients in ANC and PMTCT. But I was constrained with knowledge and told mothers to come the next day Also the attitude of clients is unknown or unpredictable. Some mothers have come direct to me and wants to be tested and counselled by me, but when directed them to other staff they rejected and left.” (Nurse A, Fieldwork, November to December 2004)*

Also, in order to respect confidentiality and privacy, clients were referred from one facility/section to another without any formal information tool. The next paragraphs elaborate such situation.

VCT centres referred clients to other sections or facilities. Family planning has been sending clients to Laboratory for STI screening in the same facility. The outpatient department referred clients to VCT for counselling and Testing, and VCT sent clients to hospitals when they had certain problems. So there was a significant movement of clients within and across facilities without adequate referral information.

However, communication was passed from one section or provider to another orally, if the clients themselves were willing to do so. For example, voluntary counselling and testing centres, after finding a client was positive, referred them to family planning centres. However, whether this information was communicated or not this family planning centre depended on the openness of the client. One provider had the following to say:

*“Some mothers told me that ‘I have been told to come here by VCT people because of this’. But others don’t say, and you just have to guess from her condition or discussion with her. It will be better if VCT develop a form which will be used to refer mothers to family planning.”* (Nurse A, Fieldwork, November to December 2004)

There are also different practices of medicine which give varying emphasis on the recording of patient information. Confidentiality is often negotiated in the quest of perceived improved services. Summarising, the confidentiality of clients resulted to different work practice between routine and PMTCT practices which result in information fragmentation such as missing information tools for some activities and non-recording of information and hence creating challenge to integrate PMTCT fully with routine information system.

### **5.2.5 Institution related**

This section presents various institutional and contextual conditions that add to the challenges of establishing and integrating PMTCT: the geographical mobility of clients between clients and the social stigma of HIV/AIDS (leading to a demand for confidentiality of information which hinders exchange).

#### **5.2.5.1 Clients identification**

In this section, I present the system that was used to identify clients in antenatal and children clinics. In the beginning, there was a unique identification number and certain rules to enforce its use when the client visited their residential clinic. However, people’s behaviours cannot be predetermined. The rule had to be often broken to fit peoples’ behaviour in favour of providing health service. The bad side of this was that client’s identification system did not change. This was followed by different approaches of tackling this. This section also shows how things were calm until the introduction of a health subsystem which required a unique identification of clients. This caused a rise in the use of local registers with different data management, poor integration of with ANC section, and different ways of handling certain information amongst health workers with the same needs.

The Antenatal and child numbers were used to identify antenatal and child clinics clients, and they were given in serial number in all the health facilities. For instance, the number 1/04 meant that the first client in the year 2004 in one facility. For clients travelling or who are on a short stay, there were different approaches. Some facilities would not record the client

details, but would indicate it on her card. If client had moved permanently in one area, she would be registered in a register and be given the facility number and some information would be transcribed from the previous card to the new one. For family planning cases, the register was used to register day to day attendances, the remark column was used to note if the client was from another facility. However, if this client was immunised, she would be tallied in the same tally sheet as other clients. One facility did this differently by using a local register to record details of the client. The tallying and local registering was done in order to have consistency between the use of immunisation resources and the number of clients who attended.

In brief, the need to know the number of residents and non residents arise from the fact that facilities need to review its targets and performance. That is, every facility (applies most for public facilities) is serving a certain area and is responsible for delivering services such as immunisation and antenatal care to all women in that area with a given population. The population rates, for example, children under one year or women of child-bearing age are relevant in order to calculate the indicators relating to the percentage of children immunised or pregnant women accessing antenatal care. Whether targets have been met or not, can then be assessed. When calculating targets only residents information is needed. However, in order to know how much vaccines were used or the load in antenatal clinic in order to supply enough resources, there is a need to account for both residents and non-residents cases.

My informants told me that more than ten years ago, clients of the MCH service were supposed to attend the designated residential area clinics (facility officially serving particular ward/streets/villages). The health facilities, to control this had a list of the herdsman of streets/villages/hamlets displayed on the walls. When a mother attended a clinic, and if the address or herdsman name she provided was not in the list, she would be told to attend a clinic in her area. During the research, the following reasons were identified as causing mothers attend other clinics:

- **Vicinity to home:** Some designated facilities were far from areas where a client was staying and non-designated ones were nearer. This mostly happened in cases where the clients were living on the borders of wards. Given below is the diagram which schematically depicts such a situation.

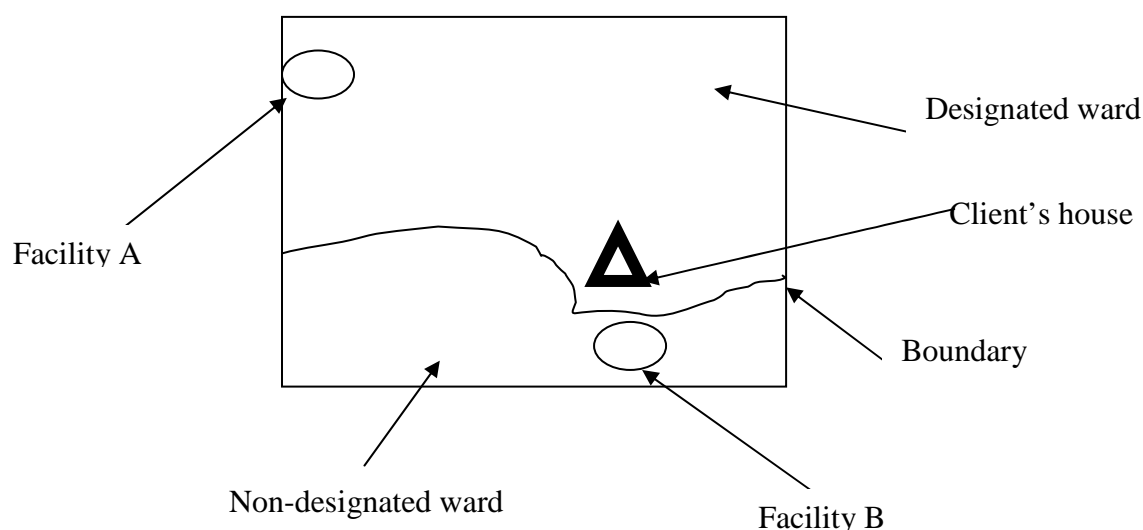


Figure 5.1: Diagram illustrating the vicinity between a facility and client house

Examples of such situations were found in Vingunguti dispensary and Buguruni health centre where by most Mtambani street residents in Vingunguti ward preferred to attend the Buguruni health centre to the Vingunguti dispensary due to the reason of vicinity.

- **Town centres:** Clients preferred the facilities located at the town centres because the location might be near the work, shops/markets, or had easier transport access. This was found to be the reason for Mnazi Mmoja health centre and Town clinic dispensary facilities to have many clients, and from different locations of the towns.
- **Better care/handling:** Some clients attended other facilities because they thought there was better handling/care by its service providers or some kind of health care service which was not available in the residential clinic. For example, during the study it was found that some clients went to other facilities to follow PMTCT services. There were also examples of some clinics in which some clients thought that the service providers cared more than in other facilities.
- **Stigma:** Girls who became pregnant at an early age, for reasons of confidentiality and social stigma, were reluctant to go to nearby clinics where they could be identified. Since a client had been going there to a clinic all the time, the providers were familiar to her, and going to another facility where she would not be recognised was a better option. Such



situations were encountered in the PMTCT register at one facility where the address showed that some clients came from other areas which also had such services.

- **Cheap price/favour:** public facilities had more clients than private ones because children were treated freely, or the prices were lower if the antenatal client was sick and would need to pay higher prices of payment in the private clinics. During the study, I also visited three private facilities and found these to be significantly less crowded than the public ones. I even examined the registers and realised that this was a regular trend even though they were ward designated facilities.

This restriction of facilities to residents only had a negative impact, as some mothers refused to go to their residential clinics. At the time of the study, clients could obtain services in any clinic she attended. However, the organisation of identification number and design of antenatal register did not change, and the address was written on the top of every page as shown in the next diagram.

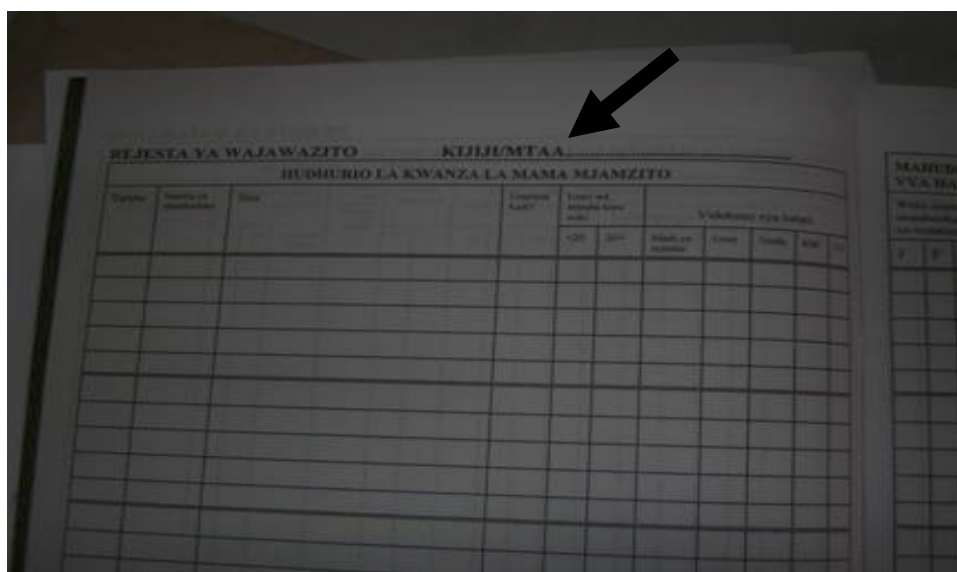


Photo 5.10: The antenatal register with address on top; indicated by an arrow.  
Source: Fieldwork at health facilities, November 2004.

Facilities had different approaches in recording clients (residents and non-residents). The first approach was to have two registers: one for service area and the other for outsiders. Despite the service area had a number of streets, the residents tended to get mixed up in one register. There were some facilities which officially served more than one ward. One example was Isevy facility in Tabora Municipality which officially served three wards: Isevy, Ipuli, and Mtendeni. There was a register for each ward plus the one for outsiders. In both kinds of

registers, the address of the residents was written on the cover of the registers or on top of every page and just written generally; Isevy, Ipuli and Mtendeni. On the covers of the register for non-residents it was written “wahamiaji” which in English could be translated to mean immigrants. This was because of the impossibility of knowing from which area the outsiders will come. There was no recording of addresses in any of the above register!

Another approach was to record streetwise plus have an additional register for non residents. For example, Vingunguti ward had the following streets: Mtakuja, Mtambani, Kombo and Miembeni. There was a register for each street. The street name was written on top of every page of the register. The fifth register was for “Vingunguti outsiders.” Similarly, there were five registers for children. So, generally in this approach, the number of registers would be the total number of streets plus outsiders, each with the address being written on the top.

The last approach used was to have two registers: one for residents and another for non-residents. In the resident register, the pages would be divided according to streets. Kiloleni facility had the following streets: Ghana, Shule, Mtakuja, Bahati, Mapambano, Bombamzinga, Mrema, Milambo, Masegese, Msikiti, Mkombozi and Magubigubi. The numbers of pages used equalled to the number of streets, and on each page the address would be written on the top.

These different local approaches affected the quality of information collected because of the missing addresses for some of the residents and for all the non residents. In both approaches, the number distribution in the registers was the same. The antenatal number in each register started with 001 and concatenated with the year and increased in serial manner until the end of the year. Often there was duplication with, at least, two clients having the same number. For example, the approach of dividing register streetwise, for facility like Kiloleni dispensary, there would be eleven 001 number: 10 from the resident book plus one from outsiders.

This was especially the case for some numbers like 01/2005, which were initial numbers because the latter numbers depended on the situation in facilities; in some facilities outsiders were more than insiders while in others it was the opposite, or it depended on which streets or wards had more clients.

The weak system of the identification number used created problems during the integration between the new information system and the existing one since the antenatal number was used to distinguish clients. After the initiation of the PMTCT services, with time the service

providers realised that it was difficult to distinguish clients. In the official PMTCT register, only the antenatal number was written. Suppose five clients with the number 001/05 were tested in one day. It was impossible to know whether you are giving the correct test results to the right person without knowing other information such as name of clients, address etc.

This was one of the reasons for local registers to be used in the PMTCT section; to distinguish clients because of the weak identification number system used in antenatal section. The other reason was that the follow up information was difficult to trace, in which antenatal register this client was located, and also detailed addresses were not recorded anywhere in the antenatal registers. For example, in the case of Vingunguti, it was not possible to identify to which register the number 001/05 belonged to or in which page is the information of a particular client registered in Kiloleni facility; the connection between antenatal and PMTCT sections is only through antenatal numbers.

The mother card (which was kept by the mothers) had an entry which could indicate in which register the client information was contained. The cards recorded the client's residential place and had been changed to include details by recording the name of a near by place to her house which could be a bus stop or a hotel. In future, it would be even more difficult to trace in which register a particular patient was because there would be many registers, and in which you would assign the code 001/04? Hence knowing patient details such as age, number of children or delivery would be impossible.

### **5.2.5.2 Communication between facilities**

In this section, I describe the system of codes which were used for communication between facilities, and show how its design affected health care services. In the mother clinic card (improvised on top), there was a code used for communication between PMTCT antenatal centres and maternity wards (labour wards). This code would show that a mother had undergone testing and her HIV status. The codes were written inside the card. Initially, the codes were written outside, but this practice was subsequently changed due to reasons of confidentiality, and the codes started to be written inside.

There was a problem with the codes used given that there were different codes in different regions. In the municipal offices, the MCH coordinators had meetings with providers and formulated the code to be used in the Municipality. For example, even though the Tabora and

Mwanza districts staff attended same training at the Bugando hospital, they used different codes. When I asked about this, the answer was as follows:

*“We were told during training that staff of certain place should formulate their own codes.”* (Nurse B, Fieldwork, November to December 2004)

In the table below, I summarise the different codes used in the different districts/regions:

PLACE	CODES AND MEANING			
	Counselled	Tested	Results( +ve or -ve)	Post-test counselled
Tabora Municipal	A	B	C/D	E
Mwanza City/Bukoba Region	3	4	5/6	7
Dar es salaam city/Mtwara region	PMTCT X	PMTCT Y	PMTCT Z/W	PMTCT J

Table 5.2: The various codes used in the different region. Source: Fieldwork, July 2004 to January 2005.

But contrary to this situation of different codes in different district/region, it was found that clients cross districts or regions. To see to what extent this was important, an examination of the PMTCT register at Isevya clinic revealed that from 12 July to 22 November 2004 there were 68 PMTCT clients who were not resident in the facility designated area. This facility officially was supposed to serve three wards only: Isevya, Ipuli and Mtendeni. I tried to list out from where these clients came from (using the local register since in the official antenatal register it was impossible to identify their location). My findings are summarised in the table below:

<b>Street/Village/Ward</b>	<b>District</b>	<b>Region</b>
Kiloleni (where there was PMTCT centre) Igalula, Kasenga, Kipalapala, Bachu, Goweko, Imalamihayo, Inara, Ndevelwa, Kazima (village)	Tabora Municipal	Tabora
Tuli, Ufuluma, Malongwe, Ipululu	Tabora Rural	Tabora
Mandeo	Sikonge	Tabora
Bukene	Nzega	Tabora
Simbo	Igunga	Tabora
Mayombo	Kahama	Shinyanga
Kasulu	Kasulu	Kigoma
Mpanda	Mpanda	Rukwa

Table 5.3: PMTCT clients from different geographical areas. Source: Fieldwork at health facilities, November 2004.

This table shows the movement of people between places, within and across districts and also regions. The movement inside the municipal in the first row could be attributed to the fact that only three facilities out of 39 offered the service at the time of the study. The table also emphasised the point of preference due to reasons of stigma where a client goes to a non-designated clinic to prevent the danger of identification. The lack of standards in the design of HIV status codes leads to ineffective horizontal communication between different facilities within and across the district. For example, I observed the record of a positive client in the local and official registers who had started antenatal visits at a particular clinic and was expecting to soon move to Dar es Salaam. The provider wondered if she would obtain service unless she became open and told the providers in the other facility. However, if standard codes were used, it may have been easier to obtain the service.

### **5.3 Summary**

This chapter has presented the situation around the PMTCT services and their associated IS. The findings emphasise how the identification of clients was impossible using the official system due to poor system of client codes with very poor integration across services and geographical areas. Fragmentation was caused due to various reasons including the client's preference of particular facilities, and different work practices between routine and PMTCT programmes. While indeed it is positive to provide clients to attend any clinic they prefer, however, this places additional demands on the integration of the different facets of the

information system. Demands for confidentiality also contributed to fragmentation, as they systems were not designed to cater for this anonymous flow of clients and information, and because of the negotiations that took place between confidentiality and improved service. The diversity of data collected and the use of local tools further contributed to these problems, for example are issues relating to recording of partners and address for follow up. These resulted in inconsistencies in data collection (different standards in fields), and means of data collection (some used a paper, other mixed men with women, others invented a tool, while others used an outpatient register). These factors posed challenges in integration of these sources. In the table below, I summarise the challenges observed in the study

<b>Category</b>	<b>Challenge</b>
System related	- Different software systems between PMTCT and RHMIS with different data format(facility based data and aggregated data) and with no sharing of data
Data related	- Different data standards in facilities caused by weak client identification system, gaps in data collection e.g. lack of tools to register partner information
Work practices related	<ul style="list-style-type: none"> <li>- Access of information limited to few staff</li> <li>- Missing information due to erasing, non-recording, staff shortage caused by confidentiality</li> <li>- Different work practice in data collection due to confidentiality, for example non-recording/recording of nevirapine syrup because of confidentiality</li> <li>- Some reports with different format sent to VCT</li> <li>- Data flowing directly to the programme managers</li> </ul>
Institution related	- Gap between people geographical movement and information system design

Table 5.4: Summary of integration challenges in the PMTCT HIS

## Chapter 6

### ANALYSIS AND DISCUSSION

This chapter analyses the empirical material presented in chapters 4 and 5. I have adopted a social-technical perspective of HIS and have drawn upon information infrastructure theory for my analysis (Hanseth and Monteiro 1998). Within this perspective, an II is seen to have many characteristics including being evolving, open, shared and socio-technical. Another central concept is that of the installed base, and this focus leads to the need for so-called ‘cultivation’ strategies if the II needs to be changed or extended. My study describes how the health II is in Tanzania was changing due to new computer system and diseases, and interventions like PMTCT, consequently requiring redefinition of various facets of the HIS. Such ongoing and future changes are also to be expected, as is by definition the nature of an II. For example, the PMTCT service now offers one-off drugs for mothers and newborn babies, but there are plans in the future to include the partner, and to also give ARV drugs through the rest of the life of the client herself, her male partner and the child born positive. This will also require consequently changes in the information systems (for example, to include partner and children information). The need is therefore for a robust and flexible HII.

The analysis presented in this chapter will help to meet the following two research objectives expressed in chapter 1: 1) to understand the challenges of integrating HIS, and the reasons for their fragmentation, more generally, and specifically in the context of the PMTCT and routine health information systems, and, 2) to study the particular approaches and strategies to deal with these challenges of integrating HIS, specifically within the context of the PMTCT and routine health information systems. Accordingly, this chapter is organised around three sections; section 6.1 which summarises the observations about the problems of non-integration, while section 6.2 analyses these challenges observed in the study from the perspective of IIs; understanding the installed base by presenting the cases of RHMIS, PMTCT and the comparison of the two cases across the districts. Section 6.3 presents the cultivation approach by suggesting some concrete ways to understand and address the integration challenges.

## 6.1 Fragmentation Problems

I have identified several instances of fragmentation and other problems of the HIS, and particularly with the PMTCT. A number of factor caused these problems:

**Software-related:** Fragmentation in information system can be software-related (Lungo 2003; Braa *et al.* 2005; Mukama 2003; Skoba 2003; Chilundo 2004), such as due to a multiplicity of programmes being used within different health programmes, such as routine HIS, PMTCT and EPI without data sharing due to different formats(data and software). Furthermore, this study showed how inflexible code, partial implementation, and poor reflection of health needs in the database system also contributed to the overall fragmentation. Data were missing in the database system since some data could not be stored in the system (refer section 4.2.4). Due to the poor analysis functionality of the system, other means of data management had to be found, such as creating data files in Microsoft Excel (refer section 4.2.1.2). Because of these characteristics of the database, multiple practices for registration and storage of information emerged, contributing to overall fragmentation (refer to section 4.2.1).

**Data-related:** Often, the use of different nomenclatures across different programmes (Braa *et al.* 2005), as well as different forms and reports across different programmes (Chilundo *et al.* 2004) contributes to fragmentation of the HIS. These reasons were also confirmed in this study, exemplified by the different age categories used between report forms for the EPI and RHMIS (MTUHA) programmes, different data format between PMTCT and RHMIS (facility based data and aggregated data). In addition, the study found that the differences in field formats and instructions between the manual and electronic forms also contributed to the problem. Also additionally, there were different data standards in facilities caused by weak integration between RHMIS and PMTCT caused by weak client identification system.

**Local work practices:** This study has described how the lack of central and universal tools and work practices has led to the fragmentation (e.g. inflexible RHMIS system, different data flow between different health programmes without data sharing, different implementation of the computer system in different districts, non-existent PMTCT tools, and different HIV codes across the regions) of the HIS. The HIS work is given low priority resulting to different ways of collection data between different facilities.



We can particularly see how the PMTCT programme was launched, without the provision of adequate tools, something that led to the proliferation of a multitude of local reporting practices. This has resulted in the local design of ad hoc register tools, such as forms, books and schemes for addressing the local information needs in the section, such as to find a solutions for registering a male partner. There have been limited attempts to standardise this variety of local practices and tools through the provision of official forms and register books. The work practices of the local health workers also had to be modified so as to handle the demand for confidentiality about HIV status. This hindered information flows between health workers, and also prevented some information from being recorded.

**Organisational and institutional embedding:** The different vertical programmes are often uncoordinated with the overall existing HIS; as they operate with their own staff, logistics (e.g. vehicles), computers and software (Braa *et al.* 2005:5), and there is a difference in data elements reported, in reporting intervals and also the administration of data (Chilundo *et al.* 2004; Lungo 2003; Skoba 2003: 116 – 138). This study also identified similar causes for fragmentation; for example, the RHMIS reports are quarterly, while EPI and PMTCT programme reports are monthly. At district level, there is no sharing of data between the managers of the EPI and RHMIS programmes. The PMTCT programme uses EPI Info package with facility based data at the national level while the RHMIS at the national level uses aggregated data from districts. In addition, the study has revealed a further cause of fragmentation arising from the fact that the HIS design was not well adapted to the social realities such as regarding private facilities with multiple interests in the health sector, dynamic nature of the health sector, and geographical movement of the clients. Regarding to MCH service, there is a widespread movement of clients between facilities and across district borders and these movements cannot be addressed through the currently designed unique antenatal numbers. In this context, a reliance on the antenatal number from the antenatal register leads to ineffective integration between ANC and PMTCT. The antenatal number used could not identify clients distinctively when giving HIV results due to the need for confidentiality, contributing to further fragmentation. In this case, institutional fragmentation (between ANC and PMTCT programmes caused by fragmentation between HIS design and clients movements between clinics/districts) leads to data fragmentation between facilities and hinders health service provision (communicating HIV results to clients) as well as to communicate between clinics in other ways (due to different codes in different regions).

### 6.1.1 The effects of fragmentation

The adverse effects of fragmentation includes duplication of work and data, lack of information sharing, poor quality of information, all contributing to poor use of information systems due to the multiplicity of channels (Sauerborn and Lippeveld 2000; Braa *et al.* 2005; Webster 1995; Chilundo 2004). This study identified similar and additional (emboldened text) adverse effects which are summarised in Table 4.1 below:

<b>Effect of fragmentation</b>	<b>Example from empirical study</b>
Duplication of work	PMTCT facilities had to invent and fill local registers apart from official registers, duplication of report compilation for immunisation data in EPI monthly form and RHMIS quarterly form
Data duplication	Overlap of data in official and local PMTCT registers
Lack of information sharing	EPI/PMTCT and RHMIS could not share data due to different standards
Poor quality of information	Missing field lead inconsistency between manual and electronic system, inconsistent data due to missing tool, missing information due to confidentiality
Poor use of information systems due to multiplicity of channels	Local registers and ways of accessing/registering information were used in parallel with official RHMIS system
<b>Hindering health care provision</b>	Antenatal number used could not identify clients distinctively
<b>Further fragmentation</b>	ineffective integration between ANC and PMTCT lead to different local inventions

Table 6.1: Summary of fragmentation effects observed in the study

### 6.2 The problem of fragmentation: the role of the installed base

In order to address the observed fragmentation problems, I argue for the process of design of the HMIS to be viewed from an II perspective; as a Health Information Infrastructure (HII) rather than a HIS. The “design” of the new system (or the extension of the old) should consider the importance of the existing systems, both technical and institutional, the installed base and its influence on the integration of the HIS (Hanseth and Monteiro 1998). This section discusses some of these influences both on the RHMIS and the PMTCT.

#### 6.2.1 RHMIS installed base and fragmentation problems

RHMIS is a programme that has been going on for many decades now and thus has a sound installed base with the following components:

- Human resources (facility, district, Ministry and international staff), with different levels of power and knowledge, and their hierarchical relationships and responsibilities;
- Work practices at the local level (how data is collected, entered in the database system, tools for data collection and reporting, and reporting intervals);
- Organisation of the health care services, e.g. private facilities with their multiple interest in the health sector, the existence of vertical health programmes (malaria, Tuberculosis etc) and their reporting systems;
- Computerised RHMIS system, with an inflexible code and other legacy systems (such as Microsoft Excel and Word).

The inflexibility of the RHMIS system has contributed to fragmentation in at least two ways.

The first one concerns the manner in which the inflexible code leads to system fragmentation because of the impossibility of adding new features locally in the district and facilities. For example, different materials or activities (e.g. the purchase of new drugs, or new activities not included in the report format) cannot be entered in the system, and the pre-programmed items cannot be changed. The inflexibility of the system also results in poor analysis of data and its limited local use.

Hanseth (2002) argues that when an infrastructure starts growing, it might lead to a lock in situation, where different users adopt different (and incompatible) standards leading to an incompatibility in the ISs (Hanseth 2002:14). This argument is also reinforced through the analysis of the RHMIS, whose fragmentation is arguably a direct consequence of the inflexibility of RHMIS. New ways (see for example figure 4.3) of accessing and storing data had to be invented to cater to the needs that RHMIS could not address. There were at least four ways of accessing and storing data: requesting data from facilities, using supervision (checklist), manual reports sent by facilities, Microsoft word and excel files developed at district level containing facility data and the computerised RHMIS.

The existence of vertical programmes also contribute to fragmentation within RHMIS because of the existence of different standards (RHMIS and EPI had different standards for immunisation data), and flows of data (monthly and quarterly) with little or no sharing between programmes. Several of the problems with the computerised HIS can be related to

the way they have been designed and developed, where they tend to reflect the requirements of higher levels, and not that of the local level. This exclusion, combined with a lack of technical flexibility, contributes to a fragmentation of systems.

### **6.2.1.1 Comparison between the computerised systems in the two districts**

In the context of RHMIS in the two districts, the installed base is comprised of the broader infrastructure such as the existing telephone/computers, transportation and communication infrastructure, number of cars owned by the DMO offices, location of the districts in relation to the Ministry and the level of urbanisation.

The fragmentation challenges observed in the RHMIS case in the two districts are almost similar because the same inflexible database system (developed centrally) is used in both places for collecting data. However, the means of collecting and accessing data in the two districts differed. Ilala Municipal depended much on the supervision of facilities and had a supervision checklist which was well detailed in order to know existing situation in various facilities. In Tabora Municipal, some files had been created, like the one in figure 4.3, but in Ilala municipal the sources ranged from Microsoft Word and Excel files, and some printed/non-printed forms from the facilities. The multiplicity of data sources in Ilala Municipal can be attributed to the fact that it had better infrastructure; the DMO office had 8 cars for supervision, some facilities owned computers and the roads were well developed which made it easy to request data from the facilities.

The second difference is related to the implementation of the computer system. Ilala Municipal received instructions to enter data from the Ministry, while in Tabora Municipal, the regional level decided on the period of entry (Ilala: year 2000 and Tabora: year 2004). The difference in instructions around entering data resulted in different datasets in terms of the periodicity of the dataset in the two districts. Ilala Municipal because of being the in the city, received formal instructions for data entry from the Ministry. However, such formal interactions between the Ministry and remotely located districts are much harder, which contributes to inconsistencies in how data is collected and recorded. This analysis shows how the level of fragmentation is influenced by the proximity of the district to the centre and the level of central control.

### 6.2.2 Role of the installed base: PMTCT programme

PMTCT is a new programme which consists of many activities (counselling, HIV testing, drug dispensing, and inclusion of male partners). From a socio-technical perspective, the installed base related to PMTCT can be defined to include the following:

- The then existing RHMIS system with non-unique identification of clients in the ANC;
- the society, its socio-economic make-up, and the HIV disease pattern;
- health workers and their work practices around the use of the data collection tools; and;
- The clients' attitudes and behaviour: geographical movement between facilities within and across the districts, demanding confidentiality.

The infrastructure grows from the installed base and inherits strengths and limitations, and which influences how it evolves (Hanseth and Monteiro 1998). The case of PMTCT demonstrates this; how the problems of the old system (RHMIS) and fragmentation are directly connected and passed on to the new system. For example, the integration of antenatal and PMTCT registers was expected to give information such as unique codes for identifying clients and their addresses. But the system which had been in use for more than 10 years failed to meet both the requirements of the health system and of the health facilities. In this case, the evolving or expansion of the II by the addition of new applications is impeded by the ineffective design of one element of the existing installed base. The problems were also further compounded by the fact that PMTCT had to meet the need for confidentiality, arising from the widespread social attitudes towards the HIV/AIDS disease, which we can describe as the 'societal' component of the installed base.

The poor identification of clients in the RHMIS system resulted in further fragmentation since it led to the magnification of local data collection activities in all the facilities offering the PMTCT services. Problems of lack of integration in the system cascaded to further problems as it brought together multiple sources of data that were locally organised. This further affected health workers because they needed to invent local tools to meet service provision. Some of the information in the local tools was not integrated, for example, the partner and mother information in some facilities.

Several of the fragmentation problems with the PMTCT programme can be related to social, organisational and institutional aspects. Geographical movements of people and the social stigma associated with HIV disease contributed to the challenges observed in the study. The low priority allocated to HIS work in general, meant to a relative neglect of attempts to standardise practices and tools comprising the HIS.

### **6.2.2.1 Comparison between the PMTCT programmes in the two districts**

The two districts had variations with respect to the socio-economic profile including population, facilities owning computers, the existing applications (such as Microsoft word), the transportation and communication infrastructure, and the level of urbanisation.

The fragmentation challenges found in the PMTCT programme in the two districts were similar because the system was centrally coordinated and used same forms, antenatal registers, antenatal number system, and reporting procedures. There was also a similar proliferation in the use of local tools in the two districts because of the constraints of the Ministry designed system.

However, even though the PMTCT service started earlier in Tabora, Ilala was more advanced in terms of the use of local tools. For example, Ilala facilities had more tools than Tabora Municipal, and some tools seen in Ilala were not seen in the Tabora Municipal. The local tools in the Ilala Municipal covered all PMTCT activities; form for client while testing (with detailed personal information), register to record both HIV and syphilis testing activities (RPR (syphilis reagent), Cappilus and Determine reagents results for each client), the ledger book used specifically for laboratory activities related to PMTCT (nevirapine drug and testing reagents), and quality assurance form when the 10<sup>th</sup> specimen was taken to referral hospital. The tools in the Tabora Municipal were local registers regarding clients' personal information. In Tabora Municipal, the tenth specimen for quality assurance was done by labelling the specimen bottle only.

In Ilala Municipal, the local tools were well developed, standardised and were mostly computer printed. Even the ledger books had been developed further by adding some columns, for example, to include recording of laboratory activities specific for acquiring Cappilus and determine. In Ilala, the forms with personal information were stored as a form for individual patients while in Tabora the information was registered in the local register. Another example concerned partner information. Some Ilala facilities had many clients and

they developed separate tools to avoid the consequences of mixing men with women. This was not the case in Tabora. The difference could be related to the fact the Ilala district was more urbanised, had better infrastructure (roads and telecommunication), and the use of local tools and inventions could be scaled up faster. This was not easily possible in Tabora.

### **6.2.3 Comparison across the cases programmes**

The case of RHMIS and PMTCT showed various differences in data administration (information officers, programme manager), software (RHMIS and EPI Info), work practices (reporting intervals, report formats at the national level (aggregated and facility based data) access to information) and institutional related. Despite PMTCT being a new programme, and involving different work practices, the fragmentation problems were quite evident, arising from the use of different data standards, local use of tools that were developed differently and diverse ways of accessing data.

Aanestad *et al.* (2005) have argued in their paper concerning strategies for development and integration of health information systems in developing countries (Tanzania, Mozambique and India), that integration is not only a technical process but a complex socio-technical process (political, national and international actors, historical process) (Aanestad *et al.* 2005). This argument is also reinforced through the analysis of the RHMIS and PMTCT cases where contributing to the fragmentation are various social realities (e.g. geographical movement of clients, dynamic nature of the health sector, private facilities with multiple interests in the health sector) not reflected in the HIS design, and also technical considerations, such as the design of the antenatal number and the use of an inflexible code, both developed by the Ministry.

### **6.3 Strategies for improving the information systems**

The study has helped to argue that integration is broader in scope than just technical, and should also include data elements, shared knowledge, joint information routines and tools. The degree (or kind) of integration must be designed so that it balances various needs. The needs vary horizontally (between various programme and personnel groups) and also vertically: between local needs (such as the primary use of information) and that of the management (secondary use of information for monitoring, administration and evaluation). I argue the cultivation approach to the development and implementation of the HII could be an

effective way to consider some of the fragmentation challenges. The next section presents some approaches to do apply such a cultivation approach.

### **6.3.1 Cultivation approach for integrating HIS**

The cultivation approach emphasises taking a socio-technical approach, which acknowledges the heterogeneity of a HIS, and a respect for the influence of the installed base (Aanestad *et al.* 2005; Hanseth and Monteiro 1998), and how it serves as the point of departure for any change effort, both as a resource and a constraint. The cultivation approach emphasises the need to not try and make changes as one giant steps, but instead as small and gradual changes (Hanseth and Monteiro 1998). 'Large-scale' problems such as economic underdevelopment, attitudes to HIV/AIDS, private facilities evading paying required income taxes, lack of adequate human resources, partly working information systems etc, cannot be solved directly through radical efforts, but gradual and incremental steps. There are various approaches to cultivation including modularisation, gateway based, and bootstrapping (Hanseth 2002; Hanseth and Aanestad 2003). I use the idea of cultivation to argue that integration can be approached by either avoiding fragmentation, selective integration or by integrating fragmented parts.

#### **6.3.1.1 Avoiding fragmentation**

The case study has shown inflexible systems are a source of fragmentation. We can try to avoid fragmentation by creating flexible (i.e. adaptable) computer systems that are sensitive to local needs (Braa *et al.* 2005). The use of flexible tools can serve as a *gateway* between the computer system and the (varying) local needs, and serve to reduce the number of local workarounds, which tends to promote fragmentation. The problems observed such as poor reflection of data needs at district and facility levels, difference in fields between the manual and electronic forms and poor analysis of data in the database system may be reduced since the locals at the district might expand the system by registering the data elements and create the reports they want.

Another mechanism to avoid fragmentation is to standardise the local forms and other tools such as separate partner tools. Tools to be developed based on the local knowledge of the health workers at facility level, and the local tools becomes a point of departure in the HIS expansion and improvement. This is a gradual, bottom-up strategy, in line with the cultivation (Hanseth and Monteiro, 1998) and 'bootstrapping' approaches (Hanseth and Aanestad, 2003).



This spreading of local innovations that are working well in other contexts is another way of creating a robust and well-adapted HIS. One example of such a situation was found at Ilala Municipal where a good form designed by one facility was copied and distributed to other facilities. The same can be done by the Ministry replicating good practices from well-functioning districts to others. Such “bottom-up learning” approaches can help to scale up working practices and avoiding “worst practices”. The bottom up learning can help in having standardised data across the facilities, so as to reflect local needs and demands of service provision. For example, some local registers from the PMTCT centres had useful information which could be useful for the higher levels.

A further mechanism to avoid fragmentation is to have integration of information as one of the strategies for new system development or extending existing components of the HMIS. This requires planning ahead on issues such as the sharing of data across programmes. Hanseth and Monteiro (1998) point out that standards are crucial parts of an IIs, and can contribute to avoiding fragmentation. Standards have a wide scope including data format between different programmes regardless of their different work practices (software, targets, reporting intervals, and other administrative issues). Integration can involve modularisation through constructing a hierarchical layer with standardised units, simultaneously supporting flexibility, and serving as an interconnecting mechanism between different modules (Hanseth and Monteiro, 1998).

A case in point is that if there were formal plans for sharing data between EPI and RHMIS, could have contributed to less fragmentation of systems. Use of EPI standards could serve as gateways to link the two programmes and their different work practices (such as periodicity of reporting and data administration) and reduce the duplication of data compiled by health workers at the facilities. The formal plans of sharing data might also be used between PMTCT and RHMIS programmes.

### **6.3.1.2 Selective integration**

There is a need to find the balance between loose and tight integration, such as in the design of the registers. The balance can help to avoid the drawbacks of tight integration as well as of no integration (very loose integration) (Aanestad *et al.* 2005). In this context, by tighter integration I mean aligning of data formats while by loose integration I mean having standards so that the separate systems can exchange information.

Coordination between entities and sub-systems need to be improved through selective integration. Where needed, linking mechanisms that are robust and flexible should be provided. Our first example is regarding the coordination between the antenatal and PMTCT clinics. There is an inherent link between the two, because PMTCT clients are coming from the antenatal clinics, making it necessary to use an antenatal number to identify clients at the PMTCT section. However, some information is not applicable to all clients, for example, the nevirapine dispensing during antenatal and postnatal periods, and breast-feeding options which is only applicable to HIV positive clients.

Also specific for PMTCT positive clients is the need to register information relevant for follow up such as their detailed addresses. In some local registers kept by facilities, detailed address was collected for positive clients to enable future up. Even though the PMTCT and ANC services are collocated in the same buildings (but different rooms) in the MCH facilities, they have different working practices (including information registering and storage) and hence making difficult in future to trace client address in the antenatal registers located in antenatal sections.

Another example is from a maternity ward where I have seen a local register that is integrating information about ANC, PMTCT and delivery. One reason was to keep track of which women who attended the particular ANC PMTCT clinic delivered in that facility. Such attempts at integration should aim for a “minimum level integration”, comprising of only those elements that are necessary and at the level that is necessary to integrate, as loosely as possible.

Also specific for PMTCT male clients, there is a need to register males separately. Example is of how partner information has been handled by the facilities (refer section 5.2.2.3.3). There was no tools to collect partner information, may be the Ministry assumed the same ANC PMTCT register to be useful. Using the same columns for recording female and males (date the client started ANC, gestation age, breast-feeding options, nevirapine dispensing) was felt inappropriate by some health workers. However, there needed to be a link between the female and male clients. Some facilities developed separate tools for recording data on male partners. Tools that are seen to be working well should be documented and spread to other facilities.

### 6.3.1.3. Proposal for robust client identification scheme

To integrate better the RHMIS and PMTCT, the coding scheme for antenatal clients needs to be redesigned. An approach to this process of developing a robust client identification scheme is by learning and adapting from other organisations experiencing similar situations in terms of reconsideration of years, residential areas and the need to distinguish clients uniquely through identification number. An example in this regard is the University of Dar es Salaam's identification number system as illustrated in the Table 6.2 below:

Number	Meaning
22437/T.99	The student with University serial number 22432 with Tanzanian nationality and government scholarship who was admitted in year 1999
P. 45678/T.2005	The Tanzanian student with University serial number 45678 with private sponsorship admitted in the year 2005
E. 34567/U.2000	The Ugandan student with University serial number 34567 admitted in 2000 in exchange programme between the Ugandan and Tanzanian governments
P. 546546/K. 20005	The Kenyan student with University serial number 546546 with private sponsorship

Table 6.2: Illustration of identification number from the University of Dar es salaam

This system avoids the problem of mixing up clients' (students') identification, and it has some similarities with clients attending antenatal clinics which need to consider years and residential area. In Tanzania, all regions and districts have MTUHA codes, for example Dar es salaam is 07 and Ilala is 03, while Tabora is 14 and Tabora Municipal is 06. Every facility has a code which is unique in the respective municipal. The facilities are serving Outsiders (O) and Insiders (I); to distinguish service area clients and non-service area ones. The clients are coming in a certain year number and needs to be distinguished by the year.

Number	Meaning
07.02.072151.001/I.2005 ( <b>region.district.facility.client information</b> )	The first client in the year 2005 at Mnazi Mmoja facility in Ilala district in Dar es salaam who is resident
14.06.012.011/O.2005 ( <b>region.district.facility.client information</b> )	The eleventh client in the year 2005 at Kiloleni dispensary in Tabora Municipal in Tabora who is not a resident

Table 6.3: Examples of unique antenatal number

To avoid missing address for non-residents, the address column should be added in the antenatal registers. Employing this scheme would be an example of a cultivation strategy that is sensitive to the existing realities of movement of clients, as well as drawing upon the existing installed base as a resource, through using the already existing MTUHA codes. Hanseth and Monteiro (1998) have described installed base as representing something which already existed and the importance of taking that as a point of departure in any attempts to improve and extend the II. However, this number system needs to be customised; for example, health managers need to investigate if the number can be used permanently for one client and the year should be changed, or for every pregnancy there should be a unique number.

This chapter presented the analysis and discussion of the fragmentation problems identified in the case studies. Two concepts; installed base and cultivation, were used as they were relevant to analyse the empirical material and to propose strategies to address some fragmentation problems identified in the study. The next chapter presents the conclusions of the research and propose some further research insights based on the empirical work.

## Chapter 7

### CONCLUSIONS

This chapter is intended to summarise how the questions posed in this thesis have been addressed, and present some conclusions. Accordingly, in the first section I present some concluding remarks which summarise some key research issues and implications both theoretically and practically. Section 7.2 presents theoretical and practical research contribution. Finally, in section 7.3, I discuss possible areas of further work based on my reflections on the research findings.

#### ***7.1 Research summary***

This study responds to the urgent need for HIS reform in developing countries by focusing on the problem of fragmentation, some of the identified underlying reasons, and some possible strategies to address this problem.

The study was conducted in two districts in Tanzania belonging to two different regions during the period July 2004 and January 2005. In both these districts, the analytical focus was on both the routine health IS and the IS relating to the PMTCT programme so as to identify the fragmentation problem both within the programmes and also between them. The study was conducted through the use of qualitative research methods including interviews, analysis of documents, and experimentation with the computer system. The use of these multiple methods of data collection helped to adjust and fine tune my analytical focus, and move from issues of data quality more broadly to that of fragmentation specifically.

The first research problem addressed was to study the challenges of integrating HIS, and the reasons for their fragmentation, more generally, and specifically in the context of the PMTCT and routine health information systems. My analysis identified the role and extent of fragmentation problems with both the routine HIS and the PMTCT. These included fragmentation related to the software systems used, the data elements collected, the local work practices, and the institutional settings. The problems of fragmentation found within the routine HIS were caused by inflexible code, poor reflection of the health needs in the database system, different data standards between the vertical programmes, different data standards between manual and electronic versions of the HMIS, and a gap between the HIS design and the social realities the system is expected to reflect. Challenges to the PMTCT programme

arose from the absence of a robust scheme for client's identification, missing tools for some activities (such as for partner information, laboratory activities), gap between HIS design and geographical movement of clients between facilities, as well as the absence of mechanisms for communicating the client's HIV status in a confidential way to other health workers. The fragmentation caused by the lack of a robust scheme for client's identification was caused by the use of an inappropriate coding scheme, which for example could not distinguish clients from residential and non-residential areas or from different facilities.

Other writers have also pointed out that the fragmentation problem inhibits the performance of the HIS, causes duplication of work and data, impedes information sharing, and results in poor quality of information and subsequent use of information (see, for example, Braa *et al.* 2005; Aanestad *et al.* 2005; Lungo 2003; Mukama 2003; Chilundo 2004). In addition to what has been pointed out by other researchers, the provision of health services also can suffer because of the poor integration between the IS (ANC) corresponding to the PMTCT programmes, for example, the problem of identifying clients using antenatal numbers in PMTCT services.

The empirical findings were analysed using an information infrastructure based conceptualisation of the HIS, specifically drawing upon the concepts related to installed base and cultivation. The information infrastructure conceptualisation also helped to propose strategies to improve the HIS based on the principles of cultivation: using the existing installed base, the use of gateway, bootstrapping and modularisation.

The second problem addressed in the thesis was concerned with the identification of particular approaches and strategies to deal with these challenges of integrating HIS, specifically within the context of the PMTCT and routine health management information systems. The comparison of the two case studies and also the inter-district comparison revealed more similarities than differences. The main reason for this was because the HIS was centrally coordinated by the Ministry, hence contributing to similar kinds of fragmentations in both the cases.

I have argued in this thesis that the problem of fragmentation can be addressed in three ways; by avoiding fragmentation; through integration of fragmented parts; and, through selective integration. A central concern should be to avoid fragmentation through providing well-working tools; both paper and computer based. A central mechanism to achieve this would be

through the use of flexible computerised tools, developed with appropriate participation of local level health workers at the facility and district levels. A short-term cultivation strategy could be to identify local well-working solutions to core problems and to spread these well functioning tools (e.g. forms) to other facilities. Standardisation of codes for communication of HIV status between different regions across the country, also need to be pursued, especially at the national level.

Better integration between the two programmes could be provided by developing robust standards such as effective codes for antenatal clients in the PMTCT section. Standards are a crucial part of any infrastructure, and can serve as gateway between two different infrastructures (Hanseth and Monteiro, 1998). In our case, the need for integration related to PMTCT is most urgent in relation to the ANC programme since the PMTCT clients are primarily ANC clients. However, there is not a total overlap between the two programmes, and some standards are needed only for positive clients, since drug dispensing and follow up is relevant only for them. Thus, there is a need to find a balance between loose and tight integration (Aanestad *et al.* 2005), such as in the design of the paper registers in PMTCT sections. There is a specific need for the available PMTCT services in terms of future follow-up, and the need to link information about the male partner to that of the female clients.

The above fragmentation challenges are caused by some work practices within the HIS such as relating to the lack of local level staff participation in system development, low priority being accorded for HIS work, and information flows reflecting primarily the requirements of higher levels, at the expense of the local level's information needs. Similar HIS related problems have also been identified in other research (see for example Mukama 2003; Lungo 2003; Chilundo 2004) which leads to missing data and poor quality of data in general. The study also had found these work practices to contribute to fragmentation within the HIS, such as the observed inconsistencies in the information collected of female and male clients, and also across facilities because of the absence of data collection tools. Making the work practices more standardised could help to address some of these problems, but however, bringing about these changes is a complex undertaking as work practices are deeply embedded in the social and political context. However, these problems need to be addressed in the long run to help contribute to addressing the fragmentation problem.

Prior research has argued that integration of data is a complex process involving not only technical issues but also political and economical ones (see for example Aanestad *et al.* 2005;

Webster 2003). This argument is also reinforced through the analysis of the two case studies of PMTCT and RHMIS in the two districts.

In summary, building on the broader perspective of II implies that integrating the HII cannot be seen as a single process but a set of multiple processes comprising of complex interdependent components (avoidance, integration and selective integration) which are deeply embedded in the broader social and technical context. The challenges experienced in the case studies clearly demonstrate the complexity and heterogeneity of factors (computer system, the role of Ministry, the role of facilities and districts, resource constraints, the society's perception of certain issues, geographical movement of people and different levels of socio-economic status) which influence the performance of HIS both within and across health programmes and districts. The analysis has shown that approaches to integrate HIS need to acknowledge what already exists, the installed base, and their enabling and also constraining influences. The cultivation approach (Hanseth and Monteiro, 1998) provided one possible approach to address these fragmentation problems while respecting the installed base, such as through strategies such as of modularisation, bootstrapping and the use of gateways.

## **7.2. Research contributions**

This research makes both theoretical and practical contributions which are now discussed.

### **7.2.1 Theoretical contributions**

Through the analysis and discussion of the empirical findings, this thesis contributes to the domain of HIS in developing countries. This study helps to develop a wider understanding of the fragmentation problem in HIS through based on detailed empirical analysis, and the application of concepts from II theory to examine the empirical data. This study has helped to emphasise the importance of integration of HIS, and how processes of design and implementation both are constituted of fragmentation issues, and its adverse implications. The specific programmes in focus in this thesis were the RHMIS and PMTCT programmes. Some of the adverse implications included the problem of communicating HIV test results because of the existing fragmentation with respect to the identification codes, which then influenced the quality of information in general regarding PMTCT. Prioritising the provision of healthcare services at the expense of registering and reporting lead to further fragmentation of



the HIS since different facilities develop their own local and different standards around the data collected, making it difficult to develop a unified HIS regarding PMTCT.

Prior research has pointed out to some of the problems of fragmentation of HIS in developing countries arising as a result of the existence of multiple vertical programmes (see, for example Lungo 2003; Mukama 2003; Skoba 2003; Chilundo 2004). While re-emphasising the problems caused by this vertical structure, this study points out to the reasons underlying fragmentation also within programmes, such as due to inflexible code, the existing gap between the design of the HIS and prevailing social realities, and poor reflection of the health needs in the computerised HIS. Thus, this research contributes to further understanding of the problem of fragmentation of HIS.

Braa *et al.* (2005) explain that fragmentation implies a lack of coordination and integration amongst the numerous sub-systems where each health programme is running their own system with little regard to how this is integrated (or not) with or beneficial to the overall HIS (Braa *et al.* 2005:5). Such a vertical structure arises because of the funding policies of international donor agencies that are programme specific (see for example Braa *et al.* 2005, Lungo 2003; Mukama 2003; Skoba 2003; Chilundo 2004; Aanestad *et al.* 2005). In contrast, this study has described the fragmentation within the subsystems of the HIS (the RHMIS and PMTCT), and how these problems are due to the lack of a proper design of the HIS.

In this study, fragmentation is described to arise when one data set is split in several places (may be with different data standards), such as in manual reports being sent from facilities, the existence of various electronic files and also in the computerised system at the district level. At the facility level, fragmentation of data can also arise when either a data set is split in official data collection forms and also in local data collection tools, or the existence of different data collection routines for the same data set leading to different data standards in different facilities. This system hinders effective accessing and sharing of information across the various decision-making units at the different levels. Fragmentation can occur within a programme (such as RHMIS or PMTCT) even though they are coordinated by the same administrative system. Integration of HIS should thus not only focus between the sub-systems but also within the individual systems. My analysis also contributes therefore on the literature relating to the evaluation of HIS, that focused on the integration of sub-system with the existing HIS (see for example Sapirie 2000).

Grimson *et al.* (2000) suggest that loose integration may be the preferred approach for the system integration across the organisations and tighter integration for within the organisation (Grimson *et al.* 2000:53). In contrast to them, I argue that there should be a balance between loose and tighter integration, even within the organisation. While more integration should be pursued in some cases, it does not need to be a general requirement, as some information within the same subsystem/unit of the organisation needs to be separate due to the nature of activities, for example, the data on the male partner and positive clients. Fragmentation within a health information infrastructure may pose different problems within different contexts, and full and complete integration of all parts may bring different result than desired one. There is a need to discuss issues such as whether the data elements need to be related and/or coordinated between the various activities of information subsystem.

### **7.2.2 Practical contributions and recommendations**

This research provides strategies on how to improve the HIS; specifically relating to the problems of fragmentation. The study thus has implications for health planners and health managers on how to design and restructure the HMIS. My main recommendations fall into two categories: eliminating the sources of fragmentation; and, improving integration. Some of the specific implications are as follows:

1. One of the most pressing challenges of PMTCT is the problems of a robust scheme for client's identification. Thus, there is a need to develop a new and robust antenatal number system in order to better integrate the RHMIS and PMTCT.
2. The needs to redesign the ANC PMTCT register by developing separate tools for male partners and HIV positive clients so that more specific information can be collected. This will help to better integrate the internal information relating to the PMTCT programme.
3. The need to adopt the use of flexible database tools, and simultaneously develop the capability of the local staff to expand the system based on their local needs. This can help to better integrate the internal working of the RHMIS.
4. To integrate individual programmes such as PMTCT and RHMIS, the study advocates the need to promote bottom-up and horizontal learning between facilities in better data management, and its coordination by the municipal. This will allow the higher levels to learn from the facility levels with the coordination of the municipal, and districts to learn from each other. One example is the form used in Ilala to be spread to other facilities.

5. I recommend the standardisation of codes used to document HIV status on the mother's card. This should be done at national level.

### **7.3 Further research**

This study explored the information system operating in PMTCT healthcare in Tanzania. Further research is required to find how the changes regarding the information problems observed, such as gaps in data collection tools, antenatal number design system, and design of ANC PMTCT registers can be introduced

Another area for further work is to explore and analyse how the balance between confidentiality of individuals and better information process can be achieved without distorting confidentiality.

## BIBLIOGRAPHY

- Aanestad, M., Monteiro, E., Kimaro, H., Macombe, E., Macueve, G., Mukama, F., Muquingue, H., Nhampossa, L.J. and Lungo, J., 2005. *Strategies for development and integration of health information systems: coping with historicity and heterogeneity*. Working paper at the University of Oslo, Department of Informatics.
- Avert organisation website: <http://www.avert.org/motherchild.htm>, <http://www.avert.org/children.htm> , <http://www.avert.org/aidsinafrica.htm> [Accessed 15 May 2004].
- Braa J., Heywood A., Sahay S., Hedberg C., and EU-BEANISH country team members, 2005. *Health Metric Network: A tool for assessing country health information systems: development, application, results and analysis*. Report submitted to World Health Organisation.
- Chaulagai, C. N., Moyo, C. and Pendame, R., 2001. Health Management Information System in Malawi: Issues and Innovations. In: *The RHINO Workshop on Issues and Innovation in Routine Health Information in Developing Countries*. March 14 – 16, 2001. The Bolger Center, Protomac, MD, USA, 117 – 118.
- Chilundo, B., 2004. *Integrating Information Systems of Disease-Specific Health Programs in Low Income Countries: The Case Study of Mozambique*. PhD thesis, Faculty of Medicine, University of Oslo, Oslo.
- Chilundo, B. and Aanestad, M., 2004. *Integrating the information systems of disease-specific health programmes: negotiating multiple rationalities*. Working paper at the University of Oslo, Department of Informatics.
- Chilundo, B., Sundby, J. and Aanestad, M., 2004. Analysing the quality of routine malaria data in Mozambique, *In Malaria Journal*, 3:3.
- Connolly, C., Begg, C. and Strachan, A., 1999. *Database systems: A practical approach to design, implementation, and Management*. Addison-Wesley, 5.

- Creswell, J., 2003. *Research design: Qualitative and mixed methods approaches*, Second edition, University of Nebraska, Linkon.
- Denzin, N.K. and Lincoln, Y.S., 1994, Introduction: Entering the Field of Qualitative Research. In: N. K. Denzin and Y. Lincoln, eds., *Handbook of Qualitative Research*. Thousand Oaks, CA: Sage.
- Department of Reproductive Health and Research (RHR), World Health Organisation. *Maternal and newborn health*. 30 March 2004. Available from <http://www.who.int/reproductivehealth/MNBH/index.htm> [Accessed 20 May 2005].
- District Medical Officer's Office, 2004. *Ilala Municipal council; comprehensive council health plan: July 2004 – June 2004*. Ilala: The United Republic of Tanzania.
- District Medical Officer's Office, 2004. *Tabora Municipal council; comprehensive council health plan: January – December 2004*. Tabora: The United Republic of Tanzania.
- Fontana, A. and Frey, J. H., 1994. Interviewing: The Art of Science. In: N. K. Denzin and Y. Lincoln, eds., *Handbook of Qualitative Research*. Thousand Oaks, CA: Sage.
- Grimson, J., Grimson, W., Hasselbring, W., 2000, *The SI challenge in health care*. Communications of the ACM, vol. 43, no. 6: 48-55.
- Hanseth, O. and Aanestad M., 2003. M. Bootstrapping Networks, Infrastructures and Communities. *In Methods of Information in Medicine* 42(4): 384-391.
- Hanseth, O. and Monteiro, E., 1998. *Understanding Information Infrastructure*. Unpublished book. Available at <http://www.uio.no/~oleha/Publications/bok.pdf> [Accessed 15 May 2004].
- Hanseth, O., 2002. *From systems and tools to networks and infrastructures - from design to cultivation. Towards a theory of ICT solutions and its design methodology implications*. Working paper at the University of Oslo, Department of Informatics. Available at:

- [http://www.uio.no/~oleha/Publications/ib\\_ISR\\_3rd\\_resubm2.html](http://www.uio.no/~oleha/Publications/ib_ISR_3rd_resubm2.html) [Accessed 15 June 2004].
- Hodder, I., 1994, *Interpretation of Documents and Material Culture*. In: N. K. Denzin and Y. Lincoln, eds., *Handbook of Qualitative Research*. Thousand Oaks, CA: Sage.
- Kanshana, S. and Simonds, R.J., 2002. *National programme for preventing mother-to-child HIV transmission in Thailand: successful implementation and lessons learned*. Lippincott, Williams & Wilkins, AIDS 16: 953 - 959, available from: [http://old.developmentgateway.org/download/125796/Thailand\\_PMTCT\\_experience.pdf](http://old.developmentgateway.org/download/125796/Thailand_PMTCT_experience.pdf) [Accessed on 16 June 2005].
- Kimaro, H. and Nhampossa, J., 2004. *The Challenges of Sustainability of health Information Systems in Developing Countries: Comparative Case Studies of Mozambique and Tanzania*. In Proceedings of the 12th European Conference on Information Systems (ECIS) June 14- 16, Turku, Finland.
- Lippeveld T., 2000, Routine data collection methods, In: T. Lippeveld, R. Sauerborn and C. Bodart (eds.). *Design and Implementation of Health Information Systems*. Geneva, World Health Organisation, 88 – 113.
- Lippeveld T., 2001. Routine Health Information System: The Glue of a Unified Health System. In: *The RHINO workshop on issues and innovation in routine health information in developing countries*, The Bolger Center, Protomac, MD, USA 14-16 March 2001. Arlington, VA 22209, USA: MEASURE Evaluation, JSI Research and Training Institute, 13 – 27.
- Lippeveld, T. and Sauerborn, R., 2000. A framework for designing health information systems. In: T. Lippeveld, R. Sauerborn and C. Bodart (eds.). *Design and Implementation of Health Information Systems*. Geneva: World Health Organisation, 13- 32 .
- Lippeveld, T. and Sapirie, S., 2000. Approaches to strengthening health information systems. In: T. Lippeveld, R. Sauerborn and C. Bodart (eds.). *Design and Implementation of Health Information Systems*. Geneva: World Health Organisation, 243 – 252.

- Lucas C. R., 1992. *The analysis, Design and Implementation of Information Systems*. Fourth Edition. McGraw-Hill International Editions, computer science series.
- Lungo, J., 2003. *Data flows in Health Information Systems: An action research study of reporting routine health delivery services and implementation of computer databases in health information*. Unpublished Master thesis, Department of Informatics, University of Oslo.
- Monteiro, E., 2003. *Integrating Health Information Systems: A Critical Appraisal*. *Methods of Information in Medicine*, vol. 42, no. 4, 2003, 428 – 432.
- Mukama, F., 2003. *A study of health information systems at local levels in Tanzania and Mozambique. Improving the use and management of information in health districts*. Unpublished Master thesis, Department of Informatics, University of Oslo.
- Nielsen J., 1993. *Usability engineering*. Academic press, A harcourt place, United states of America.
- Nsubuga, P., 2001. Surveillance: What is it? How does it relate to routine information gathering and use? Do we need it? *In: The RHINO workshop on issues and innovation in routine health information in developing countries.*, The Bolger Center, Protomac, MD, USA 14-16 March 2001. Arlington, VA 22209, USA: MEASURE Evaluation, JSI Research and Training Institute, 59-63.
- RHINO, 2001. *The RHINO Workshop on Issues and Innovation in Routine Health Information in Developing Countries*. The Bolger Center, Protomac, MD, USA 14-16 March 2001. Arlington, VA 22209, USA: MEASURE Evaluation, JSI Research and Training Institute.
- Rubona, J.J., 2001. Routine health information systems that operate in Tanzania. *In: The RHINO workshop on issues and innovation in routine health information in developing countries*, The Bolger Center, Protomac, MD, USA 14-16 March 2001. Arlington, VA 22209, USA: MEASURE Evaluation, JSI Research and Training Institute, 183 –193.

- Sapirie, S., 2000. Assessing health information systems. In: T. Lippeveld, R. Sauerborn and C. Bodart (eds.). *Design and Implementation of Health Information Systems*. Geneva: World Health Organisation, 73 – 87.
- Sauerborn, R. and Lippeveld, T., 2000. Introduction. In: T. Lippeveld, R. Sauerborn, and C. Bodart, eds. *Design and Implementation of Health Information System*. Geneva: World Health Organisation, 1-14.
- Shrestha, L. B. and Bodart, C., 2000. Data transmission, data processing, and data quality. In: T. Lippeveld, R. Sauerborn and C. Bodart (eds.). *Design and Implementation of Health Information Systems*. Geneva: World Health Organisation, 128 – 145.
- Silverman, D., 2000. *Doing Qualitative Research: A practical Handbook*. London: Sage.
- Silverman, D., 2001. *Interpreting Qualitative Data: Methods for Analysing Talk, Text and Interaction*. 2nd Edition. London: Sage.
- Skobba, T.C., 2003. *Legacy Systems and Systems Development in Mozambique: Bridging the gap between the old and the new, showing the need for change*. Master thesis, Department of Informatics, University of Oslo.
- Tanzania government website: [www.tanzania.go.tz/healthf.html](http://www.tanzania.go.tz/healthf.html). [Accessed 15 May 2004].
- Walsham G., 1993. Organisational Change: Context and Process, *Interpreting Information systems in Organisations*, John Wiley & Sons Ltd Chichester, UK., 52-71.
- Webster, J., 1995. *Network of Collaboration or Conflict? Electronic Data Interchange and Power in the Supply Chain*. *Journal of Strategic Information Systems*, vol. 4, no.1, 31-42.
- WHO. *Interim Patient Monitoring Guidelines for HIV Care and ART*. Patient ART Monitoring Meeting, 29-31 March 2004, Geneva, 1- 51. available from: [www.un.org/vn/who/docs/mekonghivtb/content/29/patientguidelines2.pdf](http://www.un.org/vn/who/docs/mekonghivtb/content/29/patientguidelines2.pdf). [Accessed on 5 May 2005].




## **BIBLIOGRAPHY**

- Wilson R., McKeown S., Bhattarai H.R., 2001. Rapid assessment of Bhutan's Health Management Information System. *In: The RHINO workshop on issues and innovation in routine health information in developing countries*, The Bolger Center, Protomac, MD, USA 14-16 March 2001. Arlington, VA 22209, USA: MEASURE Evaluation, JSI Research and Training Institute, 129 – 156.
- Wilson, R., Rohde J., Puchert, R. and Hedberg C., 2001. South Africa's District Health Information System: Case Study from Eastern Cape Province. *In: The RHINO workshop on issues and innovation in routine health information in developing countries*, The Bolger Center, Protomac, MD, USA 14-16 March 2001. Arlington, VA 22209, USA: MEASURE Evaluation, JSI Research and Training Institute, 81 -93
- World Health Organisation (WHO), 2000. *Design and Implementation of Health Information Systems*, Geneva.
- Yin, R. K., 1984. *Case study research: Design and methods*. Newbury Park, CA: Sage.

## APPENDICES

### *Appendix A: Ethical clearance*

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

 <p><b>UNIVERSITY OF OSLO</b></p>	<p>Department of Informatics P.O. box 1080, Blindern 0316 Oslo Norway Gaustadalléen 23 Phone: +47 22 85 24 10 Fax: +47 22 85 24 01</p>
<p>Our ref: Your ref:</p> <p>Oslo, 5 June, 2004</p>	<p>FACULTY OF MATHEMATICS AND NATURAL SCIENCES</p>
<p><b>To Whom It May Concern:</b></p> <p>Nima H. Shidende is a Masters student in Informatics at the University of Oslo.</p> <p>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.</p> <p>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.</p>	

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. Nima H. Shidende is doing her Masters research within HISP and as part of the HISP masters program.

We therefore kindly ask you to give her permission and support so that she can carry research within the Tanzanian health information system.

Yours sincerely



Jørn Braa

Associate Professor

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

**JAMHURI YA MUUNGANO WA TANZANIA  
WIZARA YA AFYA**

Akwani ya Sira: "AFYA", D'Salaam  
Sira Namba: 2126261  
Fax: 255-22-2139060/2124586  
Barua zote zinaandikwa kwa Katibu Mkuu



SANDUKU LA POSTA 9083,  
DAR ES SALAAM.

Unapojiba tafadhali taja:

Kumb. Na. FA 207/458/01/29

24 Juni, 2004

**Kwa yeyote anayehusika**

**Yah: KUMTAMBULISHA NIMA H. SHIDENDE**

Somo la hapo juu lahusika.

Nima H. Shidende ni Mtanzania anayesoma Shahada ya Uzamili (Masters Degree) katika Chuo Kikuu cha Oslo kilichopo Norway.

Chuo kimependekeza afanye utafiti unaohusu Mifumo ya Taarifa za Afya hapa nchini ikiwa moja kati ya masomo yake. Wilaya alizochagua kufanya utafiti huu ni Ilala na Tabora Mjini.


Kwa barua hii ya utambulisho, unaombwa umpe ushirikiano utakaomuwezesha kufanya utafiti huu. Kukamilika kwake kutamuwezesha kukamilisha masomo yake. Vile vile matokeo yake yatakuwa ya manufaa kwa Sekta ya Afya kuweza kutumia utafiti huu kuboresha Mfumo wa Ukusanyaji wa Taarifa za Afya.

  
E. W. M. Mahumbu  
k.n.y. **KATIBU MKUU**

## Appendix A.3: Example of introduction letters from the Ilala Municipal

**ILALA MUNICIPAL COUNCIL**

ALL COMMUNICATIONS TO BE ADDRESSED TO THE MUNICIPAL DIRECTOR

<b>P.O. BOX</b> 20950		<b>MUNICIPAL OFFICE</b>
<b>PHONE NO:</b> 2128800		<b>ILALA</b>
<b>FAX NO.</b> 2128805		
<b>FAX NO.</b> 2121486		

Ref: IMC / MED / R.18 / 5VOL.Y /..... Date: 06/07 / 2004

Medical Officer In Charge  
Mnazi Mmoja Health Center  
Ilala Municipality

*AKC i/c  
Please assist her accordingly.  
JK.  
5/7/2004.*

**MEDICAL OFFICER I/C  
MNAZI MMOJA HEALTH CENTRE  
DR. ES SALAAM.**

**RE: PERMISSION TO CONDUCT A STUDY ON ASSESSING THE QUALITY OF ROUTINE PRIMARY HEALTH CARE INFORMATION AND QUALITY OF THE MUNICIPAL DATABASE IN ILALA MUNICIPALITY**

Please refer to the heading above.

Nima H. Shidende, a student of University of Oslo Department of Informatics, is granted a permission to conduct the above-mentioned study in Ilala Municipal.

This study is the part of academic fulfillment of Master in Information systems in Health. After going through the proposal, She is allowed to conduct the study.

We here by request your assistance as the researcher has accepted our condition of producing a copy of study results to MMOH.

*For: Ilala Municipal Council of Health*  
*M. Lwiza*  
**ILALA MUNICIPAL**  
District Research Coordinator  
For: MMOH – Ilala Municipality

C.C: Nima H. Shidende ✓

## Appendix A.4: Example of Introduction letters from the Tabora Municipal

**JAMHURI YA MUUNGANO WA TANZANIA**

**OFISI YA RAIS**

**TAWALA ZA MIKOA NA SERIKALI ZA MITAA**

**HALMASHAURI YA MANISPAA YA TABORA**  
(Barua zote zipelekwe kwa Mkurugenzi wa Manispaa)

MKOA WA TABORA		OFISI YA MKURUGENZI WA MANISPAA
SIMU: 026-2604315/6088		SANDUKU LA POSTA 174
FAX: 026-2604835		TABORA - TANZANIA
Kumb.TMC/HQ/AD/11/101		Tarehe: 23 July 2004

Mganga Mfawidhi,  
Hospitali/ Zahanati ya *ISEVYA*  
TABORA MANISPAA.

**YAH: KUMTAMBULISHA NIMA H. SHIDENDE**

Husika na kichwa cha habari hapo juu.


Nima H. Shidende anafanya utafiti unaohusu mifumo ya taarifa za Afya hapa nchini.

Unaombwa umpe ushirikiano utakaomwezesha kufanya utafiti huu kwa kutoa takwimu zote muhimu zinazohitajika.

  
DR. M.O. Luganga  
**MGANGA MKUU WA MANISPAA**  
**TABORA**

**Appendix A.5: Example of extra introduction letter acquired after the research focus shift**

**JAMHURI YA MUUNGANO WA TANZANIA**  
**OFISI YA RAIS**  
**TAWALA ZA MIKOA NA SERIKALI ZA MITAA**  
**HALMASHAURI YA MANISPAA YA TABORA**  
*(Barua zote zipoakaa kwa Mkurugenzi wa Manispaa)*

MKOA WA TABORA SIMU: 026-262604315/8088 FAX: 026-2604835 Kumb. Na: TMC/HQ/AD/11/101		OFISI YA MKURUGENZI S. L. P. 174 TABORA - TANZANIA Tarehe: 17 December 2004
--	---	--

Mganga Mfawidhi  
 Hospitali ya Mkoa (Kitele)  
 TABORA Manispaa.

*Atu Dr. Rahabanga  
 Diba  
 21/12/04.*

**YAH: KUMTAMBULISHA NIMA H. SHIDENDE**

Husika na kichwa cha habari hapo juu.

Nima H. Shidende anafanya utafiti unaohusu mifumo ya taarifa za afya hapa nchini.

Unaombwa umpe ushirikiano utakaomwezesha kufanya utafiti huu kwa kutoa takwimu zote muhimu zinazohitajika.

Barua kumb Na FA 207/450/01/29 ya Juni 24/2004 toka wizara ya afya imeambatanishwa.

*Dugoo*  
 DR. M.O. Luganga  
 MGANGA MKUU WA MANISPAA  
 TABORA

*21/12/04 - 11<sup>30</sup> am.  
 HOIC - Maternity, p'se assist her  
 to get the information she  
 needs. *Dugoo**

## **Appendix B: Interview guide**

Field Study site:

Field Date & Location:

Start time:      End time:

Interviewee:              Position/title:              Education:              Job/post experience:

### **Appendix B1: Questions in the first phase:**

1. What does your facility do to improve quality
2. What can be done in general (in any facility) to improve data quality?
3. How is information generated at this facility used for decision making in your facility or at the municipal?

Document analysis/review of data collection registers forms and reports to assess the quality of the data in terms of completeness of columns, consistency and correctness of data.

### **Appendix B2: Questions in the second phase:**

1. What kinds of data are being collected at this facility?
2. Which are the tools used to collect and gather data?
3. How information is shared when a client go to another facility (e.g. travelling, moved due to drug shortage or permanently)
4. What are the problems related to data collection at this facility?
5. What are the reporting procedures? Which reports are supposed to be generated at this facility?

Review of data collection tools and procedures in detail of related subsection of MCH to assess the quality, integration, and duplication of data.

### **Appendix B3: Questions regarding the database:**

1. What are your views about the computer system?
2. What problems did you observe in using the new computer system?

Analysis of software screen while entering data from facilities.



**Appendix B.4: Number of interviews conducted during fieldwork**

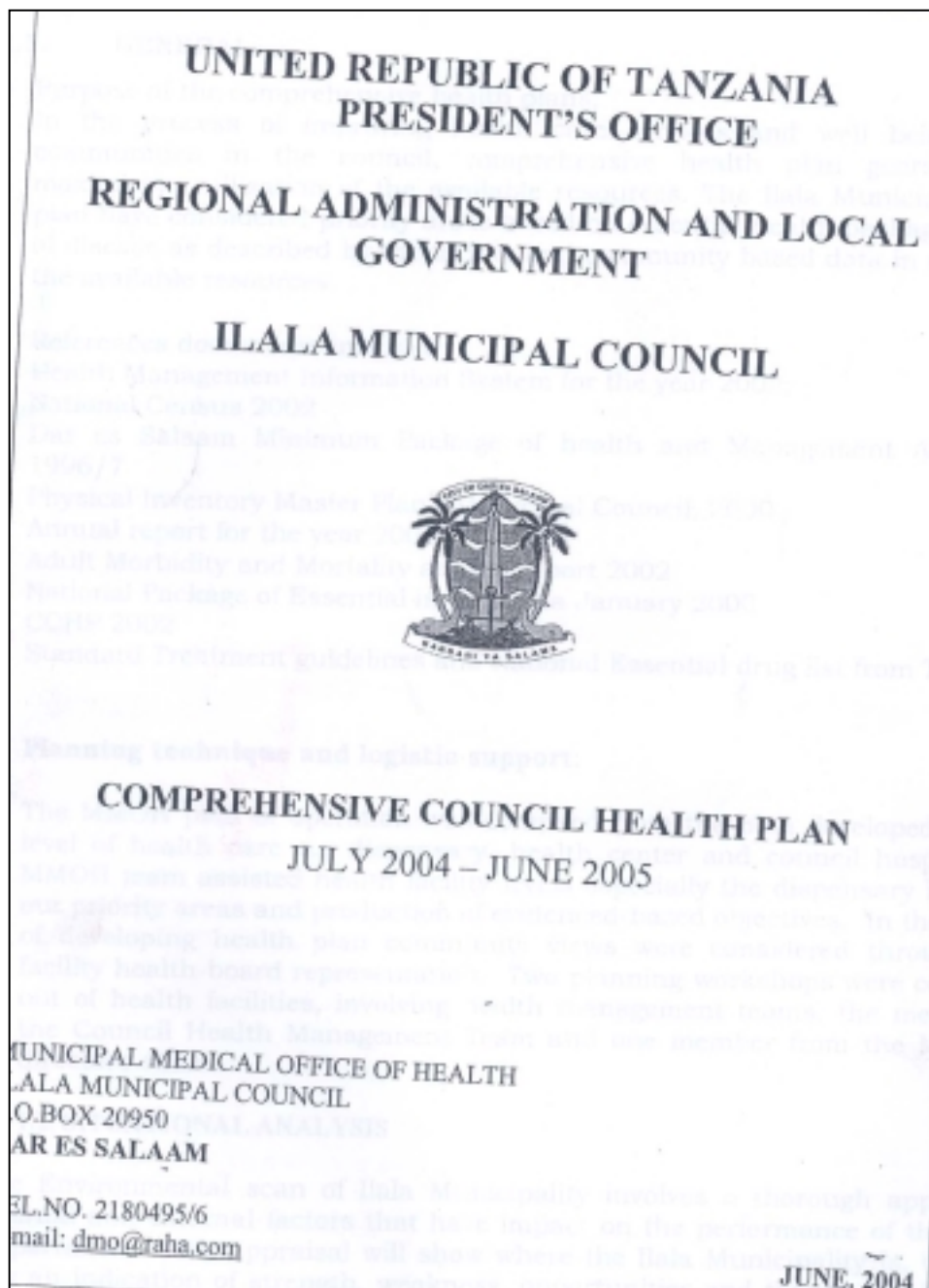
	<b>Date</b>	<b>Place</b>	<b>Interviewee</b>
Ilala Municipal	23-9 to 14-11-04	District Medical Office	One individual interview plus repeated informal discussions with four informants
	8-7-04	Mnazi Mmoja health centre	One group interview with two interviewees plus two individual interviews
	9-7-04	Ukongu mission health centre	Two individual interviews
	9-7-04	Buguruni health centre	Three individual interviews
	12-7-04	Kiwalani dispensary	Two individual interviews
	12-7-04	Vingunguti dispensary	Two individual interviews
	13-7-04	Chanika dispensary	Two individual interviews
	14-7-04	Dr Khan hospital	Two individual interviews
Tabora Municipal	23-7-04, 29-7-04	District Medical Office	Two individual interviews plus one group interview /repeated informal discussion with two interviewees
	26-7-04	Isevyu dispensary	Two individual interviews
	26-7-04	Seven Adventist church dispensary	Two individual interviews
	27-7-04	Kiloleni dispensary	four individual interviews
	28-7-04	Tumbi dispensary	Two individual interviews
	29-7-04	Town clinic dispensary	Two individual interviews
	21-12-04	Regional Health Office	One individual interview
	7-12-04 to 3-1-05	DMO office	One interview; repeated informal discussions with two informants
PMTCT	2-11-04, 7-1-05	Mnazi Mmoja health centre	Four individual interviews
	4-11-04	Buguruni health centre	Three individual interviews
	22-11, 20-12-04	Isevyu dispensary	Two individual interviews plus one group interview with two interviewees
	24-11-04	Kiloleni dispensary	three individual interviews
	25-11-04	Town clinic dispensary	three individual interviews

*APPENDICES*

	<b>Date</b>	<b>Place</b>	<b>Interviewee</b>
	21-12-04, 3-1-05	Kitete hospital	three individual interviews
	17 - 1- 05	Amana hospital	Two individual interviews
	18 -1- 05	Vingunguti dispensary	Two individual interviews

**Appendix C: Reviewed documents from the fieldwork**

**Appendix C.1: Ilala Municipal profile cover page**



## Appendix C.2: Copy of top ten disease lists from the Ilala Municipal profile

## 1.3.6. Health facilities data

Table 7: Top ten-outpatient diagnoses

Rank	< 5 Years			5 Years and Above		
	Disease	No. of Cases	% of all diag.	Disease	No. of Cases	% of all diag.
1	Malaria	96800	43.2	Malaria	66702	36.2
2	ARI	35010	15.6	ARI	32318	17.6
3	Pneumonia	27378	12.2	Diarrhoea	20766	11.3
4	Diarrhoea	20005	8.9	Pneumonia	18001	9.8
5.	Anaemia	15156	7.0	Anaemia	11233	6.1
6.	UTI	12111	5.4	Worms	9701	5.3
7.	Skin infections	6431	2.9	Skin Infections	7441	4.0
8.	Worms	5232	2.3	UTI	6288	3.4
9.	Eye Conditions	3250	1.5	Eye Infections	5444	2,9
10	Ear conditions	2888	1.3	Minor Surgical Cond.	4278	2.3

Table 8: Top ten inpatient admission/diagnosis:

Rank	< 5 Year			5 Years and above		
	Disease	No. of cases	% of all diag.	Disease	No. of cases	% of all Diagnosis
1	Malaria	3911	59.8	S. Malaria	4098	43.5
2	G/Enteritis	1014	15.5	PTB	1,108	11.7
3	B/Pneumonia	806	12.3	G/Enteritis	978	10.4
4	Anaemia	439	6.7	Malaria	802	8.5
5	Burns	118	1.8	Clinical Aids	613	6.5
6	UTI	102	1.5	PID	511	5.4
7	ARI	63	0.9	Anaemia	486	5.2
8	PTB	42	0.6	B/Pneumonia	466	4.9
9	Poisoning	28	0.4	ARI	197	2.1
10	Clinical Aids	14	0.2	Hypertension	168	1.7

Appendix C.3: The manual MTUHA form with explanation of indicators

**RIPOTI YA ROBO MWAKA YA KITUO(F004)** *АКТ РАБОТЫ КЛУБА* Ukarasa 3

Schemu 8. Vigezo vya kituo (vinahitajika kutoka vituo vinavyomilikiwa na Serikali za Mitaa)

Jaza kigawe na kigawo kinoka ukarasa wa 1 na 2. Fanya hesabu ya kigezo kwa kila swali. Kuna tatizo kabwa sana (wapo kigezo kipo nje ya lengo na kiwango cha chini kabisa. Andika N (ndiyo) au H (hapana) sehemu ya Tatizo.

Swali	Kigawe	Kigawo	Kigezo	Lengo CK, Tatizo? (Y/N)
1. Je, wastani wa mahudhuro katika OPD kwa wataarishi kitaoni yalikuwa yanaridhisha? (angalia sehemu ya 7 - mahudhuro)	Idadi ya mahudhuro OPD	Jumla ya siku za kazi katika robo mwaka	_____	90 80 _____
2. Je, mahudhuro ya muna wajasawzito yape chini sana? (angalia sehemu ya 7 - kliniki ya wajasawzito)	Idadi ya woteja ANC	Lengo la idadi ya watoto wa umri chini ya mwaka 1 katika robo mwaka	_____ x 100	90 80 _____
3. Je, wajasawzito wanasipa kinga ya pepopanda (dazi 2-5)? (angalia sehemu ya 7 - kliniki ya wajasawzito)	Jumla ya wajasawzito waliopepa chanzo ya pepopanda dazi 2-5	Idadi ya woteja wa ANC	_____ x 100	90 80 _____
4. Je, idadi ya wanawake wanaozalisha kliniki na wanaozalishwa na TBAs waliopepa mafaniso ni chini sana? (angalia sehemu ya 7 - uzazi)	Jumla ya waliomlithwa (kitasiri, BBA na TBAs waliopepa mafaniso)	Lengo la idadi ya watoto wa umri chini ya mwaka 1 katika robo mwaka	_____ x 100	60 40 _____
5. Je, watoto wote walio wa umri chini ya mwaka 1 waliandikishwa wote na umri chini ya mwaka 1	Idadi ya watoto waliandikishwa wote na umri chini ya mwaka 1	Lengo la idadi ya watoto wa umri chini ya mwaka 1 katika robo mwaka	_____ x 100	90 80 _____
6. Je, kiwango cha chanzo ya DPT3 kwa watoto walio chini ya umri wa mwaka mmoja kipo chini sana? (angalia sehemu ya 7 - chanzo za watoto)	Idadi ya chanzo za DPT 3 kwa watoto wa umri chini ya mwaka 1	Lengo la idadi ya watoto wa umri chini ya mwaka 1 katika robo mwaka	_____ x 100	90 80 _____
7. Je, kiwango cha chanzo ya Saramba watoto wote chini ya umri wa mwaka mmoja kipo chini sana? (angalia sehemu ya 7 - chanzo za watoto)	Idadi ya chanzo za Saramba kwa watoto wa umri chini ya mwaka 1	Lengo la idadi ya watoto wa umri chini ya mwaka 1 katika robo mwaka	_____ x 100	90 75 _____
8. Je, watoto wote wote chanzo ya Saramba wote tulo chini sana? (angalia sehemu ya 7 - chanzo za watoto)	Idadi ya watoto wote wote chanzo ya Saramba	Idadi ya watoto waliopimwa uzito wote wa chanzo ya Saramba	_____ x 100	2 6 _____
9. Je, idadi ya woteja wapya wanasojiruga na umri wa mpango ni chini sana? (angalia sehemu ya 7 - uzazi wa mpango)	Idadi ya woteja wapya wa umri wa mpango	Lengo la idadi ya wanawake wa umri 15-49	_____ x 100	10 5 _____

"x 100" maana yake kigawe kinazidishwa kwa 100 ili kupata kigezo.

(Tazitiwa kwanza ukarasa wa 1)

\_\_\_\_\_

\_\_\_\_\_









**Appendix C.7: Monthly summary form for the ANC PMTCT programme  
from facility level to district level (blank)**

UNITED REPUBLIC OF TANZANIA MINISTRY OF HEALTH		
Form - 2 PMTCT Antenatal Clinic (ANC) Monthly Summary Form		
Facility: _____	Level of Facility: _____	Month of Report: _____
District: _____	Date Form Completed: _____	Year of Report: _____
Region: _____		Contact : _____
<b>ANC Counseling and Testing</b>		
<b>All women attending ANC for the given report period</b>		<b>Number</b>
(STARTANC) ANC 01 New ANC clients this month.....		_____
(NPRECOUN) ANC 02 Not pre-test counseled (ANC02 = ANC 01 – ANC 03) .....		_____
(PRECOUN) ANC 03 Pre-test counseled.....		_____
(HIVDECL) ANC 04 Did not have HIV test (ANC 04 = ANC 03 – ANC 05) .....		_____
(HIVTEST) ANC 05 Had HIV test.....		_____
(HIVNEG) ANC 06 Tested HIV-negative.....		_____
(PSTNEG) ANC 06.1 Post-test counseled.....		_____
(PSTNEGNC) ANC 06.2 Not post-test counseled (ANC 06.2 = ANC 06 – ANC 06.1) .....		_____
(HIVPOS) ANC 07 Tested HIV-positive.....		_____
(PSTPOSC) ANC 07.1 Post-test counseled.....		_____
(PSTPOSNC) ANC 07.2 Not post-test counseled (ANC 07.2=ANC 07 – ANC 07.1) .....		_____
(HIVUNK) ANC 08 Tested but no definitive result (ANC 08 = ANC 05 - ANC 06 - ANC 07) .....		_____
<b>ANC Partner Testing</b>		
These numbers do not always relate directly to the numbers of women starting ANC this month		
(PARTTEST) ANC 09 Number of partners tested for HIV.....		_____
(PARTNEG) ANC 09.1 Tested HIV-negative.....		_____
(PARTPOS) ANC 09.2 Tested HIV-positive.....		_____
(PARTUNK) ANC 09.3 Tested but no definitive result (ANC 09.1+ ANC 09.2 + ANC 09.3 = ANC 09) .....		_____
<b>ANC Antiretroviral Coverage</b>		
Numerator data of women starting on drug during the report period. These numbers do not relate directly to the numbers from the Antenatal Counseling and Testing section		
(MOMNVP) ANC 09 Started on, or given NVP in ANC. ....		_____
(MOMAZT) ANC 10 Started on, or given AZT (complete only if AZT is distributed) .....		_____
<i>PMTCT-MS Ministry of Health June 2004</i>		

### Appendix C.8: Data processing for PMTCT at national level (blank)

Form 1 - PMTCT Antenatal Clinic (ANC) Monthly Summary Form		Date of Report:	02-08-2003
Facility:	<input type="text"/>	Level of Facility:	<input type="text"/>
District:	<input type="text"/>	Date form completed:	<input type="text"/>
Region:	<input type="text"/>	Month of Report:	<input type="text"/>
		Year of Report:	<input type="text"/>
<b>ANC Counseling and Testing</b>			
<i>All women attending ANC for the given period.</i>			<b>Number</b>
(STARTANC)	<b>ANC 01.</b>	Women starting ANC this month .....	<input type="text"/>
(NPRECOUN)	<b>ANC 02.</b>	Not pre-test counseled .....	<input type="text"/>
(PRECOUN)	<b>ANC 03.</b>	Pre-test counseled .....	<input type="text"/>
(HIVDECL)	<b>ANC 04.</b>	Did not have HIV test .....	<input type="text"/>
(HIVTEST)	<b>ANC 05.</b>	Had HIV test .....	<input type="text"/>
(HIVNEG)	<b>ANC 06.</b>	Tested HIV-negative .....	<input type="text"/>
(PSTNEG1)	<b>ANC 06.1</b>	Post-test counseled .....	<input type="text"/>
(PSTNEG2)	<b>ANC 06.2</b>	Not post-test counseled .....	<input type="text"/>
(HIVPOS)	<b>ANC 07.</b>	Tested HIV-positive .....	<input type="text"/>
(PSTPOS1)	<b>ANC 07.1</b>	Post-test counseled .....	<input type="text"/>
(PSTPOS2)	<b>ANC 07.2</b>	Not post-test counseled .....	<input type="text"/>
(HIVUNK)	<b>ANC 08.</b>	Tested but unknown/lost result .....	<input type="text"/>
<b>ANC Partner Testing</b>			
<i>These numbers do not always relate directly to the numbers of women starting ANC this month</i>			
(PARTTEST)	<b>ANC 09.</b>	Number of partners tested for HIV .....	<input type="text"/>
(PARTNEG)	<b>ANC 09.1</b>	Tested HIV-negative .....	<input type="text"/>
(PARTPOS)	<b>ANC 09.2</b>	Tested HIV-positive .....	<input type="text"/>
(PARTUNK)	<b>ANC 09.3</b>	Tested but unknown/lost result .....	<input type="text"/>
<b>ANC Antiretroviral Coverage</b>			
(MOMNVP)	<b>ANC 10.</b>	Started on, or given NVP .....	<input type="text"/>
(MOMAZT)	<b>ANC 11.</b>	Started on, or given AZT .....	<input type="text"/>
<i>MustEnterCoded</i>			