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SIMON MSHANA

Health management information system evaluation

Lesson from Tanzania

Doctoral dissertation

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Author´s address:
Department of Health Policy and Management
University of Kuopio
P.O. Box 1627
FIN-70211 KUOPIO

Supervisors:
Professor Juha Kinnunen, Ph.D
Department of Health Policy and Management
University of Kuopio

Dr. Mikko Korpela
Kuopio Centre for IT Education and Research CENTEK
(Healthcare Information Systems Research and
Tools Development Unit)
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Kuleuven
Belgium

Dr. Geofrey Kiangi MD, Ph.D
Ministry of Health
P.O. Box 9083
Dar-es-Salaam
Tanzania

Opponent:
Professor Dr. Walter Sermeus
Hoogleraar Programmadirecteur Medisch-Sociale Wetenschappen
Centrum Ziekenhuis- en Verplegingswetenschap
Kuleuven
Belgium

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ABSTRACT

This study concerns the evaluation of the health management information system in Tanzania, popularly known as MTUHA in Kiswahili. The system was introduced countrywide between 1994 and 1997. At present it is implemented across all levels of health care delivery. Four specific aims, which include sub-aims, were taken into account: *firstly*, to describe the health information systems in Tanzania, which includes (i) describing the design/development of health management information system, and (ii) identifying types of data collected in primary health care as well as data handling and transmission at different hierarchical levels; *secondly*, to examine the quantity and quality of collected data by (i) assessing different tools for data collection for the year 1998, and (ii) assessing knowledge of the information system, motivation by salary, and the attitude of facility workers towards the management information system; *thirdly*, to examine data utilization at different hierarchical levels; and *fourthly*, to construct a framework for health management information evaluation.

Purposive sampling was employed in the selection of one region from among the twenty-one regions of the country. Multistage random sampling was employed in the selection of two districts from eight districts in the selected region, and also in the selection of ten primary health care facilities. Combined methods were used to obtain a total of eighty-seven respondents who participated in the study. Sixty PHC workers were conveniently selected, of whom thirty-seven volunteered for focused group discussion. Again, for convenience, fifteen and ten members of the district and regional health management teams (HMTs) were included, as were two officials from the Ministry of Health.

Three questionnaires were employed for PHC workers and members of DHMTs. A question guide was used in the group discussion with PHC workers and Ministry of Health officials. Finally, a checklist and photographs were also used. Data for this study was collected from May to August 2000. The Scientific Programme for Social Science (SPSS) has been used to analyse the data, which are presented in the form of tables, graphs and photographs.

The results show that there is no existing policy for the information system. However, the Ministry of Health, in collaboration with donors with a participatory approach, has managed to establish a working information system for routine health data collection. Lack of training on MTUHA contributes data of poor quality. Training on MTUHA was in the order of 53% (32) among PHC workers and 67% (10) and 60% (6) among district and regional health management team members respectively. Variation among cadres exists. As a result, 47% (28) could not define the HMIS. Facility workers consider the information system useful: it assists in the collection of relevant data for day-to-day use. A moderate level of information utilisation for decision-making has been realized, these include the quantity of drugs to be ordered, conducting follow-up of antenatal women and family planning users and also follow-up of children defaulting from the vaccination schedule. Over 90% of PHC workers are dissatisfied with their monthly salary and the lack of allowances during supervision. Availability of allowances only to staff at upper levels is a disincentive to PHC workers. Overall, the kind of supervision conducted is poor, with little input into maintenance of the information system.

Finally, it is feasible to conclude that an acceptable approach, recommended by the World Health Organisation, and also experiences from other studies are necessary in the design and development of management information systems. Proper and adequate training of management information system implementers across all levels is crucial for the generation of data of quality as well as for information use. Supervisors should efficiently and effectively perform their role if the information system is to produce the kind of data and benefits expected. Furthermore, the consideration of incentives for all actors involved in the information system is important for the achievement of set goals and objectives.

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Medical Subject Headings: management information systems; information management; information systems; evaluation studies; organisation and administration; models, theoretical; developing countries

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TIIVISTELMÄ

Tämä tutkimus käsittelee Tansanian terveyshallinnon tietojärjestelmän evaluaatiota, joka tunnetaan suahilin kielellä yleisesti lyhenteellä MTUHA. Järjestelmä otettiin maanlaajuisesti käyttöön vuosina 1994-1997. Tällä hetkellä järjestelmää toteutetaan kaikilla terveyspalvelujen tuottamisen tasoilla. Neljä nimenomaista tavoitetta, joilla on myös alatavoitteet, otettiin huomioon: ensinnäkin haluttiin kuvailla tansanialaista terveystietojärjestelmää, joka sisältää (i) terveyshallinnon tietojärjestelmän suunnittelun/kehittämisen kuvailemisen, ja (ii) perusterveydenhuollosta kerätyn tiedon tyyppien tunnistaminen, sekä tiedonkäsittely ja tiedonsiirto hierarkian eri tasoilla. Toiseksi haluttiin tutkia kerätyn tiedon määrää ja laatua (i) arvioimalla tiedonkeruun eri työkaluja vuodelle 1998, ja (ii) arvioimalla tietoutta tietojärjestelmästä, palkan innostavaa vaikutusta, ja terveydenhuollon työntekijöiden asennetta hallinnon tietojärjestelmää kohtaan. Kolmanneksi haluttiin tutkia tiedon käyttöä hierarkian eri tasoilla, ja neljänneksi rakentaa viitekehys terveyshallinnon tiedon evaluoimiseksi.

Valittaessa aluetta maan 21 alueen joukosta käytettiin harkittua otantaa. Monitasoista satunnaisotantaa käytettiin, kun valittiin kahta piiriä kahdeksan piirin joukosta valitulta alueelta, ja myös valittaessa perusterveydenhuollon toimipisteitä. Yhdistettyjä menetelmiä käytettiin valittaessa yhteensä 87 haastateltavaa, jotka osallistuivat tutkimukseen. Sopivuussyistä valittiin 60 perusterveydenhuollon työntekijää, joista 37 ilmoittautui vapaaehtoisiksi tavoitteelliseen ryhmäkeskusteluun. Viisitoista ja kymmenen jäsentä valittiin piiri- ja alueellisten terveyshallinnon tiimien jäsenistä, jälleen sopivuussyistä, sekä kaksi terveysministeriön virkamiestä.

Perusterveydenhuollon työntekijöiden ja terveyshallinnon tiimien jäsenten kohdalla käytettiin kolmea eri kysymyslomaketta. Perusterveydenhuollon työntekijöiden ja terveysministeriön virkailijoiden ryhmäkeskustelussa käytettiin kysymyslistaa. Lopuksi käytettiin myös tarkistuslistaa ja valokuvia. Tutkimusta varten kerättiin tietoa vuoden 2000 toukokuusta elokuuhun. Yhteiskuntatieteiden tieteellistä ohjelmaa (The Scientific Programme for Social Science, SPSS) on hyödynnetty tietojen analysoinnissa. Tiedot esitetään taulukkoina, kaavioina ja valokuvina.

Tulokset osoittavat, että tietojärjestelmälle ei ole olemassa vallitsevaa menettelytapaa. Terveysministeriö on kuitenkin yhteistyössä osallistuvien kehitysavun lahjoittajamaiden kanssa onnistunut luomaan toimivan tietojärjestelmän rutiininomaiseen terveystiedon keräämiseen. MTUHAn koulutuksen puute tuottaa heikkolaatuista tietoa. MTUHA-järjestelmään liittyvää koulutusta oli 53%:lla (32) PHC-työntekijöistä, ja 67%: lla (10) ja 60%:lla (6) piiri- ja alueellisten terveyshallinnon tiimien jäsenistä tässä järjestyksessä. Henkilöstön joukossa on vaihtelua. Siitä johtuen 47% (28) ei osannut määritellä terveyshallinnon tietojärjestelmää. Terveydenhuollon työntekijät pitävät tietojärjestelmää hyödyllisenä; järjestelmä auttaa päivittäin käytettävän asianmukaisen tiedon keruussa. Päätöksenteossa tiedon hyödyntämistä on toteutettu kohtalaisesti, kuten päätettäessä tilattavien lääkkeiden määrästä, raskausajan seurannassa ja perhesuunnittelussa, ja myös niiden lasten seurannassa, jotka eivät pysy rokotusaikataulussa. Yli 90% perusterveydenhuollon työntekijöistä on tyytymättömiä kuukausipalkkaansa ja korvausten puuttumiseen tarkastusmatkojen aikana. Korvausten myöntäminen vain ylempien tasojen henkilöstölle on perusterveydenhuollon työntekijöille lannistavaa. Kaiken kaikkiaan valvonta on heikkotasoista, ja tietojärjestelmän ylläpitoon panostetaan vain vähän.

Lopuksi todettakoon, että on mahdollista päätellä, että hyväksyttävä lähestymistapa, jota Maailman terveysjärjestö WHO suosittelee sekä kokemukset muista tutkimuksista ovat tarpeellisia hallinnoinnin tietojärjestelmien suunnittelussa ja kehittämisessä. Kunnollinen ja riittävä koulutus hallinnoinnin tietojärjestelmän käyttöönottajien parissa kaikilla tasoilla on ratkaisevan tärkeää tiedon laadun tuottamiselle sekä myös tiedon käytölle. Ohjaajien tulisi työskennellä tehokkaasti ja pätevästi jos tietojärjestelmän halutaan tuottavan toivottua tietoa ja hyötyjä. Lisäksi kaikkien tietojärjestelmässä mukana olevien toimijoiden kannustinten huomioon ottaminen on tärkeää tavoitteiden ja päämäärien saavuttamiseksi.

Yleinen suomalainen asiasanasto: tietojärjestelmät; hallinnointi; terveydenhuolto; tiedonhallinta; arviointitutkimus; hallinto; mallit; teoriat; kehitysmaat

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This academic marathon began as far back as 1995. In that year, I undertook a course in health education and health promotion. The course came after almost 10 years of continuous unsuccessful application to undertake advanced studies. When the time came, it so happened that even before the completion of the advanced diploma, I was admitted to a Master's Programme in Public Health at the University of Kuopio for 1997-1998. My studies in Kuopio, in the ideal environment in terms of facilities and under supportive supervisors, inspired me to continue with the marathon to doctorate level.

Nevertheless, it was not easy to choose a proper area for the doctoral thesis without considering the areas of most constraint in the Tanzanian health care system. Like many other developing countries, Tanzania to a great extent lacks sound decisions and plans for proper management of the scarce resources available or allotted to the heath care system. With this in mind, I considered undertaking an academic degree that would lead to involvement in health care administration and planning. I consider that this choice is still a valid one up to this moment and beyond.

The will to complete this marathon could have been insufficient if not for support from many people and institutions that in one way or another, physically, psychologically and socially, contributed valuable incentives. Indeed such people and institutions are too numerous for all to be listed in this particular work. However, a few especially deserve mention.

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Finally my beloved family deserves my utmost appreciation, as its members have missed my close tender loving care for a number of years. For them, I can only say that it is your unending patience that has enabled me to attain what I have today.

Simon M. Mshana

DEDICATION

This work is dedicated to my father, Daniel Christopher Hussein, my mother, Dorah Daniel Hussein, and my beloved uncle, Peter Abdalah Kisumo.

"A commitment to life-long learning is not an optional extra but a
strategy for professional survival" (Shaw 1998).

LIST OF ABBREVIATIONS

AIDS	Acquired Immunodeficiency Syndrome
AMO	Assistant Medical Officer
AMREF	African Medical Research and Foundation
BBA	Born Before Arrival
BCG	Bacilli Calmette Guerin
CBD	Community Based Distributors
CCM	Chama Cha Mapinduzi
CO	Clinical Officer
CORP	Community Own Resource Person
DANIDA	Danish International Development Agency
DCCO	District Cold Chain Operator
DDH	Designated District Hospital
DHC	District Health Committee
DHMT	District Health Management Team
DMCHCO	District Maternal and Child Health Coordinator
DMO	District Medical Officer
DMOH	District Medical Officer of Health
DRH	Division of family and Reproductive Health
DTLC	District Tuberculosis and Leprosy Coordinator
EBP	Evidence-Based Practice
EDS	Essential Data Set
EPI	Expanded Programme on Immunisation
EPI	Expanded Program on Immunization
FGD	Focus Group Discussion
FP	Family Planning
GIS	Geographical Information System
GMP	Growth Monitoring and Promotion
GNP	Gross National Product
GTZ	German Technical Cooperation Aid
HCAC	Health Centre Action Committee
HELINA	Health Informatics in Africa
HERA	Health Research for Action
HFA	Health For All
HIS	Health Information System
HIV	Human Immunodeficiency Virus
HMIS	Health Management Information Systems
HSR	Health Sector Reform
IDS	Integrated Disease Surveillance
IDSS	Institutionalisation Decision-making Support Systems
IMF	International Monitory Fund
ISCC	Information Strategy Co-coordinating Committee
ISD	Information System Development
IT	Information Technology
KCMC	Kilimanjaro Christian Medical Centre
LMIS	Logistics Management Information Systems
M&E	Monitoring and Evaluation
MBDS	Minimum Basic Data Set
MCHA	Maternal and Child Health Aides

M-HISE	Multi-dimensional Health Information System Evaluation
MIS	Management Information System
MISWG	Management Information System Working Group
MSH	Management Science for Health
MTUHA	Mfumo wa Taarifa za Upashanaji Huduma za Afya
MUCHS	Muhimbili College of Health Sciences
NGO	Non-Governmental Organisations
NHIS	National Health Information System
NHP	Nation Health Policy
NMW	Nurse Mid-Wife
NORAD	Norwegian Agency for Development Cooperation
OH&S	Occupational Health and Safety
ORS	Oral Rehydration Salt
OSD	Health Service Delivery
PAHO	Pan-American Health Organisation
P-GIS	Participatory Geographical Information System
PHC	Primary Health Care
PHCSP	Primary Health Care Support Programme
PHN	Public Health Nurse
PMO	Prime Minister's Office
PSP	Participatory Spatial Planning
RHMT	Regional Health Management Team
RMO	Regional Medical Officer
SAP	Structural Adjustment Program
SEARO	South East Asia Region Office
SMIS	Service Management Information System
TANU	Tanganyika African Native Union
TBA	Traditional Birth Attendant
TH	Traditional Healer
TPDF	Tanzanian People's Defence Force
TT	Tetanus Toxoid
TWG	Tanzania Working Group
UN	United Nations
UNAIDS	United Nation AIDS
UNDP	United Nations Development Programme
UNFPA	United Nations Fund for Population Activities
UNICEF	United Nation International Children's Fund
USAID	United States of America International Development
VHC	Village Health Committee
VHP	Village Health post
VHW	Village Health Worker
WHO	World Health Organisation
WB	World Bank
WHR	World Health Report

LIST OF FIGURES

LIST OF TABLES

LIST OF PANELS

LIST OF ILLUSTRATIONS

LIST OF APPENDICES

TABLE OF CONTENTS

1. INTRODUCTION

1.1 Background Information

The current study concerns the evaluation of the Health Management Information System (HMIS) in Tanzania. The primary goal of the information system was to satisfy information needs for day-to-day use, for health management, and for monitoring and producing selected indicators at all levels of the health care delivery system. The Health Management Information System (HMIS), a system within the health care system, takes into account linkage with both management and provision of care. The information system has specific roles and terms of reference at each level of the service. The roles include data for management, data for monitoring of services and service outputs and outcomes, as well as data for health status and disease surveillance (Health Research for Action 2000). The history of the current HMIS dates from the early 1970s when the first surveillance (specific diseases) information systems were introduced. Thereafter, the need for more data at the central level was realised and followed by introduction of a data collection system in 1983. The introduced health information system was for recording attendances and diseases. In the 1980s, a proliferation of donor-funded programmes occurred, with each programme collecting its own data from the same health facilities. These programmes were able to collect more data than the HIS introduced in 1983. Such basic systems for data collection and compilation in public and Non-Governmental Organisation (NGO) health facilities existed country-wide until before 1991. Each programme had its own separate reporting system (Ministry of Health 1993a).

This means that the information systems were fragmented and adopted a top-down approach. There was also ineffectiveness in the system given the aim of this management tool, to collect data for use in decision-making at the region, district, health facility and community levels. Other disparities that existed were the lack of reliability of the health data and information, non-use of information by collectors, lack of training and lack of supportive supervision (Ministry of Health 1993a). In view of the foregoing facts, the Tanzanian Ministry of Health (MoH) decided to establish an integrated and properly functioning HMIS called in Kiswahili "Mfumo wa Taarifa za Uendeshaji Huduma za Afya" (MTUHA). The term MTUHA will hereafter be used synonymously with HMIS. The first pilot-testing of MTUHA was done in the Mbeya rural district between 1986 and 1988. With assistance from DANIDA, the pilot- testing was further developed and implemented the whole of the Mbeya region in 1993. Between 1994 and 1997 MTUHA Version 1.0 was introduced nation-wide. Despite its country-wide implementation, the system has many problems, which range from training of its implementers across all levels, through supervision, and the quality of data collected to data transmission. Other disparities include lack of incentives for motivation and utilisation of the data across all levels of health care delivery. As such, this study will reveal certain disparities which have not been noted in other studies conducted in the same setting.

The relevance of this study is based on the fact that regardless of various recommendations from individual authors, scientific gatherings and international and multilateral organisations, there still exist marked constraints in the health management information system. Although almost ten years have passed since the introduction of the HMIS in practice in the united republic, as yet there has been no comprehensive independent study conducted to describe the development of the information system in relation to the health care delivery system, or to determine the quantity, quality and utilisation of data and information at different hierarchical levels of health service delivery. Other reasons for conducting this study originate from observations by the Ministry of Health and the World Health Organisation: "There is low data analysis and utilisation, delays of information at all levels are not unusual" (Ministry of Health 1993a cf. World Health Organisation 1997). For example, among other management issues, a delay of information resulted in late publication of the 1997 annual health abstract (Ministry of Health 1997).

From the international perspective, it is reported that there is an absence of systematic research to assess and monitor implementation of HMIS by health system stakeholders. Data from Thailand, the Philippines, and Mexico unsurprisingly show a heavy dominance of clinical, biomedical, and laboratory research, which take up from 60-90% of total research expenditure. There was little research on health information systems, field epidemiology, demography, behavioural science, and economics and health management (Health Research 1990). On the basis of the above explanations, this study is especially important at this particular time of health sector reforms.

What, therefore, does this study have to offer that has never or only partially been offered by other studies? How does the study support other studies and available literature? The valuable information that has been partially documented in other studies is more deeply explored in the current study. This has been made possible by the use of sound methods for data collection as well as by tracking the system from the bottom up. More specifically, this study describes the design and development of the information system in relation to the health care delivery system of the country in question, the quantity and quality of collected data, the utilisation of information at different levels of data collection and service delivery, and the introduction of a multi-dimensional Model for Health Information Systems Evaluation (M-HISE), a framework that has been developed after analysing the design and development of the information system in question. In the final part of this study, there are practical recommendations specifically directed to different actors from different levels of health care delivery, as well as different stakeholders involved in one way or the other in the information system. In general, the study also contributes to a better understanding of how to proceed with information systems, not only in Tanzania, but also in other developing and developed countries.

1.2 Health Management Information: an Overview

In 1850 Lemuel Shattuck, a founding father of the American Statistical Association, outlined the basis for public health organizations. He provided a detailed recommendation of 'nomenclature for causes of diseases, death and routine collection of data by age and sex' (Lilienfeld & Lilienfeld 1980). During the subsequent 145 years, information systems for health have progressed far beyond the classification of morbidity and mortality data (Campbell 1997). At present, 153 years later, the information systems have advanced and been remodelled to incorporate subsystems. According to Tofayel (in Campbell 1997), such sub-systems include (i) Service Management Information Systems (SMIS), (ii) Logistics Management Information Systems (LMIS), (iii) Personnel Management Information Systems (PMIS), and (iv) Financial Management Information Systems (FMIS). The system mentioned by Tofayel aims at ensuring the effective delivery and utilisation of services through effective flow and management of data and remedial action based on the findings (World Health Organisation Southeast Asia Region Office 2002).

With time, the advancement of information systems has changed the role of the information system department in an organisation. In many ways the roles of information departments have broadened considerably over the last decade (Symons et al. 1991, DeLone et al. 1992, Husein 1993, Pitt 1994b, Bonner 1995). This advancement is in accordance with the expanding needs for information as well as the technology available, the viability of which requires justification. Symons et al. (1991) note that information systems are frequently used to enhance organisational performance without necessarily bringing any reduction in cost, and produce benefits which are often intangible. Equally, benefits are noted in the widely circulated World Development Report of 1993, which suggested: "revamping the health information system is an attractive investment, both because it is relatively inexpensive and poor decisions based on inadequate information can be very costly" (World Bank 1993).

It has been established that health care delivery is primarily dependent on data/information. Providers of care need information about the patient and also information about the appropriate care that could be provided in a given situation (Bertrand et al. 1988). The administration needs information to make appropriate provision for health care and to assess the utilisation of resources in the delivery of care. Similarly, policy-makers, managers, researchers and health professionals need information on which to base decisions (Lippeveld 1997).

The WHO Global Review Report has noticed that despite this extensively established need for information, information systems in many health care organisations are inadequate. However, in comparison with the developed world, the magnitude of the information gap is greater in developing countries. The report highlights the fact that "despite rapid information developmental changes and realised benefits, most developing nations have not yet had access to information systems provided by the kind of advanced health information system in the western world" (World Health Organisation 1987). Awareness of the gaps within information systems in developing countries prompted the World Health Organisation (WHO) to consider the need to establish and strengthen health information system (HIS), especially with a view to the attainment of the global goal of Health For All (HFA) by the year 2000. This is recognised in the 35th target of the Health For All policy, which urged member states to share appropriate and relevant health and health-related knowledge to enable attainment of the global goal of HFA by the year 2000 (World Health Organisation 1981c & 1992).

In addition, according to the WHO Global Review Report, "a major constraint reported by practically all countries is inadequate information to support the managerial process" (World Health Organisation 1987). Subsequently Campbell (1997) observes that despite the substantial attention given to the need for information and also to collection, interpretation and dissemination of information, there is no specific mention of any processes related to using the information to improve policy and management decision-making. Thus information systems tend to be data driven instead of action driven, and act as obstacles to management rather than tools for management use (Lippeveld 1997).

In realisation of the existing gulf, the WHO mission on information systems is to collaborate with member states in the generation and use of appropriate health information to support decision making, health care delivery and management of health services at the national and sub-national levels. To achieve this mission, the World Health Organisation (1987) has set out the following functions within the programme of development of health information systems (HIS):

- to support the strengthening of national health information systems based on an explicit analysis of the information needs
- to contribute to the strengthening of monitoring and evaluation functions and their integration into the national managerial process through the implementation of effective information systems
- to co-ordinate the efforts of partners and countries in the field of health indicators measurement and use, health data management, and evaluation of health information systems.

The department of information in the WHO assists countries to integrate the different sub-systems of a national health information system (IDS - Integrated Disease Surveillance, DRH - Division of Family and Reproductive Health etc.) in the collection, validation, analysis and dissemination of country data and other relevant programmes.

In support of the above effort, the International Conference on Population and Development outlined the following specific objectives related to health and population information: to strengthen the national capacity, to seek new information and to meet the need for basic data collection, analysis and dissemination. Furthermore, the conference's Plan of Action states that "valid, reliable, timely, culturally relevant and internationally comparable data form the basis for policy and programme development, implementation, monitoring and evaluation" (United Nations 1994). Almost identical recommendations have come from the World Health Organisation South-East Asian Region Office, with the emphasis on strengthening health information systems among member countries (World Health Organisation Southeast Asian Region Office 2002)

1.3 Strengthening information systems at district level

With the gradual shift in the direction of decentralizing primary health care management, the district team has been given significantly increasing managerial responsibility. Emphasis has been placed on "strengthening district health systems" and within this context occasional references to HMIS can be found (Janovsky 1988, Kielmann et al. 1990, Asamoa-Baah 1992). This has been an important development as the district has a more manageable scope of responsibilities and decision-making authority. The district links the central policy-making body to the most peripheral care providers, thus producing a number of problems for the hierarchical information flow (Shortliffe 1991). The information flow in a health care management system is defined as the bi-directional information flow from one hierarchical level to another (Power et al. 1984). In practice, the flow may be uni-directional, or only part of the information may be transferred upwards in the system (Sjöstrand 1981, Goldberg 1985, World Health Organisation Southeast Asian Region Office 2002). Further, the information may also be retarded, changed or lost (Power et al. 1984). The flow system contains time-consuming activities such as data collection, data processing, data analysis as well as evaluation and feedback (Shortliffe 1991).

Although health information systems are well established, some basic problems can be identified. For example (WHO 1992), notifies that HIS's are too centralised and rigid. The information required to provide a need-based distributed primary health care (PHC) service is greater than is usually expected, and management of information is a great problem (Barnet 1987). According to Campbell, the information is in large amounts and in the form of raw data aggregated from the lower level for a variety of vertical health programmes (Campbell 1997). The World Health Organisation cautions that large amounts of data continue to be collected but without specifying the use of the data to provide information on needs and priorities. More consideration should also be given to the analysis of data, data interpretation, and presentation of information, including feedback to local managers, users and data producers (World Health Organisation 1992).

The growing emphasis on health information, particularly information generated by service statistics, has not been entirely positive: obtaining such information is not as straightforward as it may seem and health workers may spend too much of their time filling in forms and registers. A WHO study revealed that 40% of the working time of an average primary health care worker in developing countries was spent on filling in forms and collecting information by manual methods (Helfenbein 1987, Feuerstein 1993). In addition, the validity of the data deserves special attention because the questionable validity of data threatens the credibility of the system. Therefore education and training is crucial in all sectors and at all levels (World Health Organisation 1992).

Any piece of information can be evaluated for two primary values: timeliness and accuracy (Helfenbein 1987). However, among common problems noted by the WHO were the fact that many HIS data routinely reported by health service staff are of dubious validity: adequacy and quality, completeness and timeliness of data produced through routine health recording and reporting mechanisms are therefore frequently considered unreliable. The poor availability of information to users results in insufficient use of available data for planning, implementation, case and service management as well as for monitoring and evaluation (World Health Organisation 2002). System quality and quality of information has been extensively studied (McCall 2002, Symons et al. 1991, Husein et al. 1993, Pitt 1994b, Bonner 1995, Ballantine 1996, Seddon 1997, Nykänen 2000, and Turunen 2001 and 2003).

The existing management information systems in developing countries are often designed to support the administration and are thus report-oriented: they convey head counts from the care providers to the higher level administration. In their support of the bureaucracy, the information systems developed were designed to meet the needs of a few (usually external) experts or agencies. When the problem was overcome, for example, eradication of smallpox, and when the policy is abandoned or resources dried up, the associated information system collapsed (Campbell 1997). Health Information Systems tend to be biased more towards procedures than performance (Chen 1986), and many decisions on policy, planning and resource allocation are made without analysis of information that is readily available (Campbell 1997, Crease et al. 1997, Walt 1994, Waddington et al. 1997).

1.4 Health care delivery in Tanzania: a historical perspective

The history of the health care system in Tanzania can be divided into two periods: the colonial and the post-colonial eras. Although elaboration of this history may seem irrelevant to people already exposed to the same, a brief summary of the historical background is necessary for a proper understanding of this work. The relevance of the overall Tanzanian health structure to this study has already been explained above. Mosse and Sahay (2003) provided similar background details among other important aspects of the context of the Mozambique health system.

1.4.1 Colonial era

As in other African country, the history of health services in Tanzania will never be complete without mentioning the role (positive or negative) played by the former colonial masters in establishing these services. According to Korpela (1994), post-independence experiences in many African countries affected by colonialism are similar. The German colonial authorities established the first health services in Tanganyika between 1888 and 91. Such services were only possible in the coastal areas of Tanga, Pangani, Bagamoyo, Dar es Salaam and Kilwa (Clyde in Ministry of Health 1990 and 1994). The development of services inland followed later, being guided by economic and administrative factors. However, the expansion of the services was thwarted by the outbreak of World War I (1914-18), and later also by the outbreak of World War II (1939-45).

The period between years 1916 to 1920 saw the devotion of effort by the new British colonial power to the construction and/or re-establishment of a civil medical service, on which the current Tanzanian health services are based. However, the Titmus report in 1966 (Ministry of Health 1990) observed that since that time there had been minimal reform to Tanzanian (mainland) health services. Despite the efforts of the colonial masters, the services established did not reach all Tanzanians, as in fact they were primarily intended to serve the colonial masters and their African staff. There was also a lack of sufficient professionals to meet the required expansion of the services. In this respect, the colonial government made no efforts to develop health services in the rural areas of Tanzania. The services established were aimed at serving the colonial masters and their support staff, and those established in the urban areas were mostly curative (Ministry of Health 1990). However, in spite of this disparity, religious missionaries from Europe developed hospitals largely in the rural areas. By 1944, Tanganyika had 6,600 hospital beds, of which 60% were in government facilities, 30% in mission facilities and 10% in the hands of industrial or private organisations. Once again, however, most of the services established were curative.

1.4.2 Post-colonial era

Tanzania became independent from the colonial rule of Britain in 1961, and rural health centre and dispensary services rapidly expanded thereafter. At independence (1961) there were 22 health centres and 875 small, meagrely staffed and equipped dispensaries operated by local authorities. The average number of people served by each facility was 11,700. There were about 100 hospitals, 40 of them run by voluntary agencies, mainly churches. The physicians working in the country numbered 415, only twelve of whom were Tanzanians, and there were 380 rural medical aides. The total number of nurses was 1400 (Aarnikko et al. 1980, UNICEF 1990). In order to meet the rapid expansion of services, a medical school was established in Dar es Salaam in 1962 to train personnel to staff health facilities (Schulpen in Julkunen 1995).

In 1964 the Tanzanian government approved the first five-year plan for 1964-1969. Health services were considered an integral part of the overall plan (Ministry of Health 1990). In order for the services to reach the poor Tanzanians, the 90 percent who lived in the rural areas, the ruling party (Tanganyika African Native Union, TANU) issued directives to be implemented by the government (Ministry of Health 1990 & 1994). One of the major directives was that the health service should be made available to all Tanzanians and should be free of charge, except for grade II & I services (Ministry of Health 1994, 1997 and 1998a). To facilitate this obligation, the government discouraged development of private for-profit services. However, supplementation of government services by non-profit non-governmental organisations (NGOs) was permitted. The framework was in line with the party's ideology, which did not allowed profit-making in social services. The ideology also protected the majority of Tanzanians who could not afford to pay for health services (Ministry of Health 1994). The party policy of the nationalisation of certain health care facilities in 1970 led to a long period of mistrust and lack of confidence on the part of the remaining facilities. As a result, this nationalisation retarded the expansion of a complementary health care system.

In his speech delivered in Parliament on 12 May 1964, in relation to the first five-year National Plan, the first President of the country, the late *Mwalimu* Julius K. Nyerere (1922-1999) outlined the following three main national objectives:

- to increase the per-capita income of the population
- to be self-sufficient in health personnel requirements and
- to increase the life expectancy of all from 35-40 years to 50 years.

In 1977, private for-profit health services were banned under the Private Hospital (Regulation) Act, and the practice of medicine or dentistry as commercial services was similarly prohibited. This legislation was amended by the Private Hospitals Regulation Amendment Act 1991, which allowed individual qualified medical practitioners and dentists to manage private hospitals, subject to the approval of the MoH (Ministry of Health 1992 and 1994). In a similar development, the country had already introduced user-charges by 1993 and is currently considering alternative health service financing methods (Ministry of Health, 1994). Furthermore, private health facilities are being established in increasing numbers in urban areas (Chiduo 1991, Kiwara 1994).

The second five-year National Development Plan (1969-1974) was based on the Arusha Declaration, and the third five-year Plan (1976-1981) emphasised the need to provide clean water, health services in rural communities and training for paramedical staff. Major achievements were noted: for example, 72% of the rural population lived within 5 kilometres of a health care facility, and 93% within 10 kilometres (Jonsson 1986, Ministry of Health 1990 & 1994, Juntunen 1997). At the end of the 1970s, the twenty-year Long Term Plan (1981-2000) was worked out (Ministry of Health 1990, Juntunen 1997) Major objectives in the health care sector were the strengthening of preventive health services, human resources and community participation (Ministry of Health 1990, Sabai 1995).

During the whole of this period (1961-1990) overall party policy was guiding the ministry of health in undertaking its programmes and projects, and there was no specific national health policy. This negated the proper and rational preparation and implementation of programmes and projects (Ministry of Health 1990). The first National Health Policy (NHP) as such was written in 1990 and approved in 1991 and based on the country's ideological framework. Overall party policy, originally outlined in 1967 in the Arusha declaration, and later reformulated in 1971 and 1991 (Ministry of Health 1990, Juntunen 1997), aimed at improving the health status of all people wherever they are, in both urban and rural areas, by reducing morbidity and mortality and raising life expectancy. In the new national health policy, the organisation of health services included co-operation with other sectors in the implementation of primary health care (PHC). In other words, commitment to PHC was undertaken before the international Alma-Ata declaration (UNICEF 1990, Chiduo 1991, Kiwara 1994, Trips and Swantz 1996).

The Fifteen-Year Party Programme (1987-2002) and the other party guidelines on economic development have shown the need to improve and maintain the quality of health care services for the whole population (Ministry of Health 1990). In the 1990s, through the Structural Adjustment Programmes (SAP), the government allowed NGOs and the private sector to provide health services at cost (Munishi 1995), which may have a definite impact on equity and access to services for the poor. According to Finnida (1992), the population per health facility was 7500:1, and statistics show that there has been a shortage of trained health professionals in the country. Population per medical staff was in the order of 1000:1 per nurse and 2300:1 per physician (Ministry of Health 1996). Consequently, the government health units often face a shortage of trained manpower and low staff morale, as well as inadequate equipment and insufficient drugs. A user fee for government hospital services was introduced in 1993. Private health facilities are being established in increasing numbers, especially in urban areas (Chiduo 1991, Kiwara 1994).

1.4.3 Levels of health care delivery

The health care system in Tanzania has been established on the basis of the existing governmental administrative and management structure: "... de-concentration an approach of decentralization was adopted by the government in 1972" (Ministry of Health 1994). Thus the management of health care services was divided into two levels: (i) the national level under the Ministry of Health, responsible for the management of consultant and specialized hospitals, paramedical training institutions and national health programs, and (ii) the regional level under the regional administration, responsible for the administration of regional and district health services. The management of health services was further divided in 1982 when the government adopted devolution, as another form of decentralization, by the re-introduction of local governments. Local governments were entrusted with the administration of health facilities below hospital level, except in a few cases whereby municipal or city councils managed hospitals (Ministry of Health 1994). The decentralisation of services in 1972 and 1982 gave autonomy in decision-making to the regional and district authorities. According to the plan, devolution of authority to regions, districts and local authorities should increase the health system's responsiveness to local conditions and needs. Furthermore, decentralization promotes the development of health services by taking advantage of locally available resources and placing more emphasis on the needs of the community (Ministry of Health 1994). As different levels exist and are entrusted functionally to different administrative authorities, it is therefore sound practice to introduce them individually.

Pyramidal type of health care services: The health care system and especially the government referral system, from dispensary to consultant hospital, assume the pyramidal pattern of a referral system recommended by health planners (Ministry of Health 1994). According to the Ministry of Health, the structure of health care services in Tanzania is divided into eight levels: family level, village level, dispensary level, health centre level, district level, regional level, referral level and national level. The national level comprises national hospitals and the Ministry of Health, which is responsible for policy formulation and administrative issues (Ministry of Health 1998a).

Significantly, although the health system administration of Tanzania follows the hierarchy as summarised in Figure 1 below, the MoH deals with all administrative matters. Independently of this bureaucratic structure, other supplementary health facilities or services include those offered by government institutions such as the Tanzanian People's Defence Forces (TPDF), the prisons and educational institutions. Other health service providers are religious groups, Non-Governmental Organisations (NGOs), bilateral bodies such as the German technical cooperation agency (GTZ in Germany), Norwegian Aids Development (NORAD), and the Danish International Development Aid (DANIDA), to name but a few, as well as private corporations and companies. In other words, the services are decentralised and functionally entrusted to different administrative hierarchies and institutions, thus distributing decision-making autonomy. It is therefore important to elaborate further on the individual levels.

1.4.3.1 Primary level

The primary level consists of the family, village health post (VHP), dispensary and health centre. At this level, with the exception of the VHP, which is under the village government as mentioned earlier, the local government authority is charged with the smooth running of the health services by means of a subsidy from the central government (Ministry of Health 1994 & 1999).

According to the Alma Ata declaration on the concept of Primary Health Care (PHC), this is the point of a health care system that is easily accessible to the community, the point of maximum encounters for the community and the base of the pyramid that represents a health care organization. Thus, primary health care is the mainstay of many health care organizations, especially in developing countries, or in countries where a socialised system health care delivery is the norm (Moidu 1993). Consequently, the care providers need information to support decision-making during the provision of care, and the administrators need the information to provide logistical support to the care providers and to enable the policy-makers to formulate regional and national health policies. Gilson et al. (1994) observed that primary care is provided from two types of health units: the dispensary and the health centre, thus excluding the VHP under the village government. The description of units under this level (primary) is as follows:

Village health posts (VHP): The VHP is the first level of health care delivery, and according to the national plan, by the year 2000 all villages in the country were supposed to have such services (this is however not the case). The VHP are to be managed by the community's own resource persons (CORP) known as village health workers (VHW). A national curriculum for their training is in place and has been extensively used for training. However, there have been a considerable number of dropouts among trained VHWs. The reasons for this dropout rate are beyond the scope of this dissertation.

Other resource persons from the community (CORP) at this particular level are, for example, traditional healers (TH), traditional birth attendants (TBA) and community-based distributors (CBD) for family planning methods, all of whom are recognised by the government. Village health workers work with the elements of primary health care (PHC) and are supposed to be remunerated by the communities themselves, as mentioned above. The government's responsibility through its structure is to train, supervise and support them with necessary materials and equipment, including a bicycle. Every village in the country should have an active village health committee (VHC) with VHWs, TBAs, and other CORPs among its members.

Although documented in many publications elsewhere, PHC elements are summarised here as follows:

i. Education about prevailing health problems and methods of prevention/control
ii. Provision of household food security and adequate nutrition
iii. Provision of adequate water supply and basic sanitation
iv. Maternal and child health, including family planning
v. Vaccination against major immunizable diseases
vi. Prevention and control of epidemics and locally endemic diseases
vii. Appropriate treatment of common disorders and injuries
viii. Provision of essential drugs and equipments
ix. Provision of mental, oral and ophthalmic health care

Some elements are universally accepted, while others vary from country to country depending on the country's priorities in its own health care setting.

The dispensary: This is the first referral level and second level of care delivery after the VHP. According to Gilson et al. (1994), a dispensary provides ambulatory curative care and maternal and child health services. More specifically, the standard of services as elaborated by the MoH is to have a maternal and child health unit (MCH), a delivery unit with at least two beds, an office for prescriptions and a dressing room. Services provided at this level range from health education on sanitation and proper nutrition and cure of minor illnesses, to family planning and antenatal, natal and postnatal services. Other services included are immunisation, child growth monitoring and promotion (GMP), outreach to villages, provision of health education in schools and among communities, follow up of TB & leprosy patients, individuals with psychiatric problems, and collection of health data. The service area of a dispensary is one administrative ward, comprising an estimated population of from 6,000 to 10,000.

Significantly, although the service offered at the dispensary level clearly needs to be staffed by more qualified and motivated people, this has not been realised by the government even after over 40 years of independence. Thus there is a need to design a "road map" for better health care services by the year 2020 and beyond.

The rural health centre (RHC): The RHC serves an administrative division with a population of approximately 50,000. It provides basic in-patient care in addition to the dispensary services (Gilson et al. 1994). More specifically, such services include an outpatient department, inpatient service, an MCH clinic and laboratory services (basic), and a dispensing unit. Other services include a kitchen (seasonal function) a non-refrigerated mortuary service and a laundry, which is not functioning (Ministry of Health 1990). According to Gilson et al. (1994), health centres are staffed by a large number of more qualified paramedical health workers, and so services offered at this level require well-trained personnel and are perceived to be somewhat better than those in dispensaries. In principle, it is the responsibility of RHCs to supervise dispensaries and act as their referral centres, and they should have motorised vehicles (4WD), motorcycles and/or bicycles, communication systems and electricity; however, these services have been compromised since the early 1980s.

1.4.3.2 Secondary level

Ideally, secondary level facilities for health care delivery act as referral facilities for the primary level and are located in districts and regions. As described earlier, mainland Tanzania has 21 regions and more than 110 districts, and these contain regional and district hospitals. The district hospital acts as referral for the health centres, and the regional hospital for the district hospitals. At these levels, all hospital issues are under the jurisdiction of the Medical Officer in charge of the hospital. However, administratively the district/regional Medical Officer remains in overall charge of the health system at that particular level (Ministry of Health 1990 and 1998a).

District hospital: As stated above, district hospitals are usually positioned within administrative districts. It is therefore appropriate to define a district before proceeding. According to Monekosso (1994) a district is a clearly defined administrative area covering a defined population (the size of which varies from country to country) in which some form of local government or administration takes over many responsibilities from central government departments. Accordingly every district in Tanzania contains a district hospital, which is either run by the government or by a religious organisation (designated district hospitals, DDH), in which case the organisation receives subsidies from the MoH. A district hospital is expected to cater for 200,000 people. Every district should have a district health management team (DHMT) which is a sub-committee of the District Health Committee (DHC) (Monekosso 1994).

Irrespective of the provider, the DHMT is responsible for all planning, implementation, monitoring and supervision (including in-service training) and evaluation of health services in a particular district. The DHMT provides support to all peripheral facilities in the form of analysis and interpretation of health data, and co-ordination of activities (see also Monekosso 1994, p. 57). Recently, as a result of the health sector reform (HSR) hospital boards are being established. According to Bossert and associates, some problems between these boards and both health management committees and the Ministry of Health have been reported in Zambia (Bossert et al. 2002). According to Litvack et al. (1998), in the last two decades, health sector decentralisation policies have been implemented on a broad scale throughout the developing world. The implementation is part of a broader process of political, economic and technical reform. In the health sector reform, this process has been reinforced by many donor-supported projects of the United States International Development Aid (USAID) and other bilateral agencies as well as multilaterals like the World Bank, the regional international banks, WHO, Pan-American Health Organisation (PAHO) and United Nations International Children Education Fund (UNICEF). The movement for health reform, including an emphasis on decentralisation, was promoted actively in the World Development Report 1993: Investing in Health (World Bank 1993).

The regional hospital: The regional hospital acts as a second referral facility for the district hospital and provides services to a population of approximately 1,000,000 people. Besides offering very similar services to those at the district hospital, more specialised and additional services such as type of medicine, psychiatry services, complicated surgery, child health, obstetrics and gynaecology are also provided (Ministry of Health 1990, 1994 and 1999). Out of 21 administrative regions of mainland Tanzania, 17 regions have regional hospitals while 4 regions (Mbeya, Dar es Salaam, Coast and the recently formed Manyara region) have no regional hospital. The Regional Medical Officer (RMO) and the Regional Health Management Team (RHMT), as well as receiving policy and administrative plans from the Ministry level, provide similar services to the DMO and DHMT respectively.

1.4.3.3 Tertiary level

The tertiary level of health care services consists of two components, namely the national referral hospitals and the national health service administration. The national administration is under the control of the MoH, while the national referral hospitals act as the final point of referral, from which patients are referred abroad in cases of inadequate technical expertise.

Consultant and specialised hospitals: There are four consultant hospitals, including the national teaching hospital at Muhimbili College of Health Sciences (MUCHS) in Dar es Salaam. Others are the Bugando Christian medical centre (BCMC) and the Kilimanjaro Christian Medical Centre (KCMC), both owned by church organisations and the Mbeya Consultant Hospital (MCH) owned by the State (Ministry of Health 1990 and 1999). Dodoma in the central zone and Mtwara in the southern part of the country have been earmarked to have referral hospitals, which would bring the number to six. The four consultant hospitals are also used for teaching purposes. In addition, there are two specialised hospitals, Mirembe in the Dodoma region (Tanzania's capital) and Kibongoto in the Kilimanjaro region. These hospitals cater for mental health and tuberculosis respectively. Administratively, medical superintendents are responsible for the referral hospitals. Overall administrative matters are dealt with at the Ministry of Health under the authority of the Permanent Secretary. As mentioned earlier, the organisation of health care services is divided between the central government and the local government, including village government.

Despite the existence of a well-defined and clearly distinguished referral system, as seen in Figure 1 below, there are several weaknesses in the system. In most cases, at the primary and secondary levels people can access the higher level (self-referrals) without initial consultation at the level below. It has been very well explained in the proposal for health sector reform that the referral system was designed in the 1960s to provide cost-effective health services (Ministry of Health 1990). However, because of the problems that developed, the health system failed to function properly. *It is common to find consumers bypassing one level of service to go to another.* The most seriously affected level is the health centre, which in most cases has failed to serve as a referral centre for dispensaries (Ministry of Health 1994). The cause of this malfunctioning or self-referral phenomenon is most probably that patients and other medical clients would look for better quality health services from the hospital they know. It could be asked if it might be viable to transform the dispensaries into health centres (one concern of the proposal for a "road map" to quality health care services by the year 2020 and beyond).

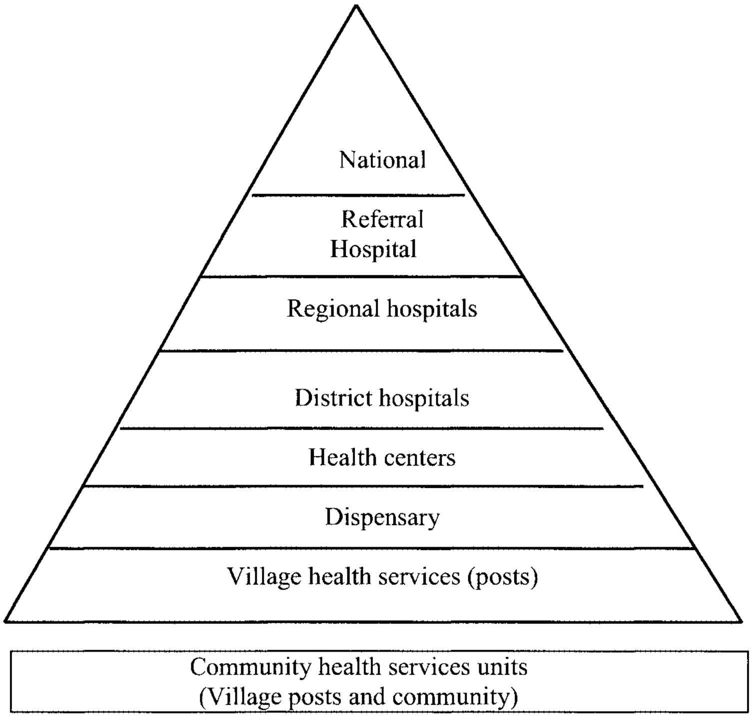

Figure 1 Health care delivery and referral system profile in Tanzania MoH 1999

The information on the health care services provided here applies to the period from 1972 onwards (for the period before 1972 see sections 1.4.1-1.4.2 above. Table 1 below sets out the distribution of health facilities in Tanzania according to region and type of health facility.

Table 1. Distribution of health facilities in Tanzania by region.

Serial/no.	Facilities			
	Region	**Dispensaries**	**Health centres**	**Hospitals**
1	Arusha*	180	11	14
2	Coast	113	10	6
3	Dar-es-Salaam	146	6	13
4	Dodoma	172	17	6
5	Iringa	141	16	13
6	Kagera	145	12	11
7	Kigoma	109	10	5
8	Kilimanjaro	135	17	13
9	Lindi	100	12	7
10	Mara	123	11	7
11	Mbeya	186	17	11
12	Morogoro	183	17	11
13	Mtwara	112	13	5
14	Mwanza	238	26	11
15	Rukwa	88	12	3
16	Ruvuma	129	13	7
17	Shinyanga	176	18	7
18	Singida	129	12	6
19	Tabora	106	11	7
20	Tanga	203	15	12
	Total	**2914**	**276**	**175**

* The newly formed (2002) Manyara Region is included in the Arusha Region

Source: Health abstract, Ministry of Health 1994.

The table above shows a variation in the distribution of health care services among the regions of Tanzania. There is a greater concentration of dispensaries and health centres in Mwanza, the second largest city and most densely populated region in the country.

1.5 Health care services financing

Although it is not my intention in this particular study to elaborate at length on the financing of health services in Tanzania, at this juncture it is worth making a few observations, as health care financing bears a clear relation to workers' morale, the running and maintenance of facilities and also the development and maintenance of the HMIS. Equally, health care financing has a direct impact on the implementation of the HMIS.

Since independence the cost of health services in government facilities has been borne by the government and health services have been offered free of charge to the citizens of the country (Ministry of Health 1990). The majority of the services, approximately 60% are provided by the Ministry of Health, the Prime Minister's Office (PMO) and local government (Ministry of Health, 1999). Similarly, the MoH finances referral hospitals and training institutions, and offers subsidies to mission and designated district hospitals (Ministry of Health 1998a). The PMO usually finances the construction, operation and renovation of regional and district hospitals. Donors support the MoH in financing projects in the regions and districts, while most vertical projects are donor-funded. The regional administration finances health facilities under their control, but may receive subsidies including drugs from the MoH.

Other key actors in health care include NGOs (approx. 35%) and private for-profit organisations and individuals (5%). District councils, with the help of subsidies from the government, fund new construction, operation and renovation of rural health centres and dispensaries. On the other hand communities contribute to their own health care through labour, cash or material for the construction as well as basic maintenance of health centres, dispensaries and VHPs, in addition to remunerating VHWs and TBAs for their work (Atherton et al. 1999). In the Ministry of Health proposal for health sector reform, it is stated that the lack of adequate financial resources has resulted in problems of low staff morale because of low wages, drug shortages, lack of equipment and supplies, and the overall deterioration of the infrastructure (Ministry of Health 1994).

As a result of rendering free health care services to its people and the rapid expansion of government health facilities and training institutions, considerable strains were put on the government budget. In response, the IMF and World Bank at the end of the 1980s set conditions on public expenditure. For example, a review on public expenditure conducted by the government in collaboration with the World Bank (WB) estimated that the government could only supply 29% of the total financial requirement (Ministry of Health 1993b). In the aftermath of this review, cost sharing in the health care system was introduced in 1993 as one conditionality for the Structural Adjustment Program (SAP) dictated by the WB and International Monetary Fund (IMF), (Ministry of Health 1993b and 1994).

2. REVIEW OF LITERATURE

2.1 Challenges to designing and developing health management information systems: experiences from developing countries.

Lack of access to information by health professionals in Africa still exists, and amounts to a major problem (Musoke 1993). The call for action to improve the information infrastructure is of global significance, and as early as 1979 an inter-regional Consultation on National Health Information System was held in Costa Rica, at the initiative of the information system support division of the World Health Organisation (Moidu 1992). A definition was agreed upon and a set of objectives that a national Health Information System should meet was drawn up. Yet the Seventh Global Review Report of the World Health Organisation expressly describes the national Health Information System of the member states as weak and unable to support the delivery of public health programmes (World Health Organisation 1987).

According to Norren et al. every country has a health information system (Norren et al. 1989). However, the systems that do exist are not utilised, which is ascribed to the lack of validity of the data (Narayana 1989). At present, such systems are weak and heavily underutilised in Africa (Ljungqvist 1985/86, UNICEF 1987). Data are collected at the most peripheral level of the health care system and fed into a largely one-way information system to the central level (Norren et al. 1989). The impetus for the development of improved information systems for health care has come simultaneously from several directions (Sandiford et al. 1992) notifies. As early as 1987 Shanawongse suggested that in order to develop appropriate information systems, research should be conducted according to needs and in accordance with local conditions and development objectives (Shanawongse 1987). The development of any system also requires a framework for evaluation (Moidu 1992). Woelk, after his experience in the development of a reporting system in Zimbabwe, recommends that attempts should be made to assure valid accurate data (Woelk 1987).

At the international level, the WHO recognises the importance of health information systems (HIS). According to Lwanga, "an HIS provides information for the management of a health programme or system and for monitoring health activities and exists as an integral part of the health system to support the health functions" (Garenne and Lwanga 1995). However, according to the same source, one of the major constraints to HIS development, especially in developing countries, is the inadequate level of resources committed to HIS development in comparison with other support functions of the Ministry of Health (WHO 2001). Inadequate general funding for the heath sector means that the information system has to compete with life-saving ventures for funding. In Zambia, for example, the information system is low on the priority list and clearly loses out year after year, the result being stagnation in the development of Zambia's information system (Kalumba 1997). Inadequate attention to the information infrastructure has resulted in difficulties with planning, monitoring, and evaluating public programmes (Moidu 1992). The weakness of information systems is due in part to the lack of attention to the infrastructure at primary health care centres, the sites of the first and perhaps the most numerous encounters between patients and the health care system, and this problem is well documented in respect of developing countries (Kholy 1984, Schware 1985, Sebaii 1987, World Health Organisation 1987).

Information system development (ISD): Information system development is the process of collective work activity facilitated by new information technology means through analysis, design, implementation and sustained support (Korpela 1998). System analysis is defined as the process of analysing a system with the potential goal of improving or modifying it (Fitzgerald & Fitzgerald 1987). This is traditionally regarded as the first stage of systems development life cycle, and a prerequisite to the successful design and implementation of information system (Foster 1993). Furthermore Foster reports that some case studies of information system failure have highlighted the lack of understanding of the human aspect as responsible for poor outcomes. This has led to more socially-based system design methodologies, which view as doomed management-imposed systems pursued without the cooperation of the operating staff in their design and implementation.

In order to maximise their effectiveness, information systems must be co-ordinated with current and future business and policy requirements of the organisation. The best way to achieve such a coordinated approach is to plan an information system strategy that will support the corporate aim and objectives, rather than simply the day-to-day business functions (Mordue 2000). The World Health Organisation recognises that a Strategic Information System provides a fundamental capability of such importance that it can enhance the scope and efficiency of the entire sector (World Health Organisation 1999). When systems analysis is applied to developing countries, certain factors often prevail. For example, potential users may not know what to expect (Foster 1993). In most cases, foreign donors give resources such as information technology (IT) equipments to hospitals. Donors always identify beforehand equipment needs for a department project, provide the equipment and then limit its usage to these projects. The central administration thus has no direct control over such equipment, which has had a bearing on the overall pace and direction of the development of informatics in an organisation (Moidu 1993). In such instances, it is difficult to use a fully participatory approach, and it has been suggested that a prototyping approach would suit such situations better (Foster 1993).

A second point is that working procedures are often not formalised, or excessively bureaucratic, and particularly so in the public sector. Under such circumstances, system developers have to use their ingenuity to get the appropriate system working, if necessary by making an improvement of the manual system the first priority, after which the computerisation stage, if still required, may proceed (Foster 1993). It has been argued that "an improved information system must be based on the existing system and the socio-economic and cultural preconditions of the country in question" (Ijadunola et al. 1998). Similarly, other key issues affecting national health information systems may be identified as being related to policy, management and information use. Thus there is a need for a clear official policy statement on information systems as a demonstration of the highest policy-level commitment to building the health system (WHO 2001).

Furthermore, lack of awareness by health policy-makers and programme managers of the strategic importance and practical usefulness of health information for planning and management results in low demand for information (WHO 2001). It is important that the National Health Information System (NHIS) provides the input in the formulation of wider regional and global health policies (Moidu 1992). Equally, another problem can be the absence of a systematic assessment of the HIS as a prelude to developing a national plan of action for HIS support within the health system. A systematic assessment is essential to ensure that the principal health system stakeholders are identified and involved, so as to enhance collective ownership and long-term commitment to the HIS. A plan of action or common framework, based on addressing the HIS weaknesses identified during the assessment, is needed to guide orderly development of the national HIS activities (WHO 2001).

The tradition of participatory design in information systems: Participatory design and evolutionary approaches to the development of information systems, in Europe particular in Scandinavia, represent a strong tradition of people-centred and democratic technological development (Bjerknes et al. 1987 cf. Floyd et al. 1989). Similarly, Moidu suggests, "an interdisciplinary team of all users of information must be involved in the development and implementation of a computer-based information system. He further stresses that "this would enhance the ownership of the system and also ensure that the system meets the needs of the team" (Moidu 1993). Moreover, involvement of communities in the planning, managing, monitoring and evaluation of health services is crucial to the PHC approach (Braa 1995). According to Braa and Ijadunola et al., the PHC approach should be the underlying philosophy for the structuring of the health system and the development of decentralised public health districts would be a crucial step in achieving the goals set. Community involvement as such is a core philosophy of PHC (Braa 1996, Ijadunola et al. 1998).

Research on information technology projects in Africa emphasises user participation (Waema 1996). The national health information system (NHIS) should facilitate community participation by providing regular, useful feedback on the achievements and constraints of the health services. Furthermore, the NHIS should facilitate the interaction between community committees and the health services by involving them in developing a local information system, which will address the needs of the community, as well as the needs of the health services. Thus in developing the information system in South Africa, a participatory approach was used (Greenbaum & Kyng 1991a&b). In the light of empowerment, participatory and bottom-up approaches, there are reasons to believe that the participatory design tradition could give important inputs to third world system development (Braa 1996), Significantly, new policies are based on the community as a key level for social development in the third world (Midgley et al. cited in Braa 1996) and such development will rely upon community participation in decision-making for social development at the local level.

There is a need to expand the participatory design tradition in order for this tradition to be adopted in third world conditions (Braa 1996). The participatory design tradition typically addresses workplace issues, while on the other hand the third world environment typically consists of economically deprived communities, where the majority might be without formal employment. For example, the process of development of the information system in Ghana is illustrative of the positive symbiotic relationship possible in North-South collaboration (Braa 1995). Financial and technical support was sought from the United Nations Fund for Population Activities (UNFPA), which organised technical assistance from the Royal Tropical Institute, Amsterdam. Similarly, Lavu (1993) reports that most of the funding for such projects as information systems computerisation is provided by donor agencies such as UNDP, which brings about the problem of constraints imposed by donors.

In view of the imperfections noted above, the World Health Organisation regional office for Africa had asked the Organisation of Health Service Delivery of the global WHO for technical support in the area of health information development for the Gambia, Eritrea and Mozambique. Despite the support that the World Health Organisation offers, the organisation recommends that HIS assessment and design tasks should be carried out by national teams or working groups, rather than performed by external experts, whether WHO staff or consultants. In this case the program's goals, objectives and operational targets were not clear: the concept of indicators was foreign, staff failed to appreciate the importance of management information and were not trained in its collection or use, and raw data flowed vertically to the programme directors bypassing key managers. There were too many forms that were incomplete, confusing, poorly laid out or often redundant, and feedback was seldom forthcoming (World Health Organisation 2001).

In developing a NHIS in Nepal, the steps included the setting of goals, targets and indicators, with modification flow of information so that everything would pass through the fledgling DHMT, and the workers would be trained in the analysis of the data they already collected. This process of information system development follows a similar line to the process carried out in Ghana, though obviously with local modification, and also with a strong technological component (Braa 1995). The health care providers considered that they need more indicators for assessing the quality of care, such as the health status of the population, indicators on the provision and utilisation of various health care services and the like (Ijadunola et al. 1998). In Kenya, to facilitate the choice of indicators, the ongoing discussion and a series of workshops led by a Management Information System Working Group (MISWG) resulted in the setting of goals and operational targets for programme divisions, definition of indicators for each program, and the determination of the sources of information (Mordue 2000). Thus, any choice of output indicator as a basis for decision-making necessarily incorporates value-judgements (Sandiford et al. 1992).

More importantly, Avgerou & Land (1992) and Avgerou (1996) stress that "it has been repeatedly pointed out that IS development methodologies designed for the affluent industrialised countries are not appropriate to the severely constrained conditions of developing countries without adaptation". As a result, much work is needed in the design, prototyping and implementation of the planned system (Ijadunola et al. 1998). Mordue (2000), when proposing a high-level national health sector information strategy in Kenya, suggested that an information strategy co-ordinating committee (ISCC) should be established to own the information strategy and oversee its implementation. Furthermore, the Health Information System Technical Working Group would advise the ISCC. Similarly, in Ghana, a Management Information System Working Group (MISWG) was set up consisting of national, regional and district personnel, supported by technical assistance. An initial situation analysis carried out by their group found a pattern typical of many countries (Campbell et al. 1991). Such strategic committees need to have the resources and authority to deliver the vision (Mordue 2000).

2.2 Professionalisation and knowledge of management information systems

In most health care settings, new professional employees come well equipped with most of the knowledge and skills needed to begin work. Non-professional personnel may require more extensive training in the health care environment. Furthermore, training should be specifically tailored to the procedures that are intended to foster learning among employees and to achieve the goals and objectives of the organisations (Nnadi 1997). Michaud et al. (1996) suggest "the most important change required today in the teaching of medicine is to foster the aptitude of future professionals for information management". Training in this area has been considered a major component in the implementation of Evidence-Based Practice (EBP), and evidence-based reasoning is an increasingly important area in medical school curricula and continuing medicine education, which is also acknowledged by other authors (Stetler et al. 1998, Sinkkonen 2000).

Consequently, employee training is more prevalent today than it was ten years ago. The motivation for providing such training varies considerably from organisation to organisation. Moreover, organisations are beginning to recognise that learning is truly a life-long endeavour and development activities such as employee training have a profoundly positive impact on job satisfaction, productivity and, ultimately, overall profitability (Hughey & Mussnug 1997). The same fact has also been realised by other human resource management advocates, who argue that both the individuals and the organisation have duties concerning life-long learning at work (McNichol & McGinni 1999, Bhatt 2001, Donner & Wheeler 2000).

In order for an in-place health information system to be effective, it requires professionals who are trained and capable of participating in the development, planning and management of information to support delivery of health care (Moidu 1993). Similarly, improving management requires a well-trained management team that takes decisive action based on up-to-date information on health problems (Smith et al. 1991). Regardless of this fact, many training programmes for health professionals and auxiliaries pay little attention to such necessary areas as planning, management and information support for health. Even epidemiological and statistical skills receive scant attention (Smith et al. 1987). As such, it is therefore unsurprising that when the graduates of these programmes begin their working careers; their skills in such areas are limited. Given awareness of this gap in their training, courses would need a balance between theoretical and practical education on the one hand, and between different disciplines on the other hand (El-Mandjira 1992). Any strategy will be incomplete without provision for trained professionals to use the tools of informatics and professionals trained to develop the tools (Moidu 1993).

Rienhoff (1989) describes the status of medical informatics education and makes recommendations for developing countries. Hanmer (1989) describes a programme utilised in an African setting. Based on these contributions, developing countries will derive the true benefit from information technology by making a clear operational policy that is best suited for their situation (El-Mandjira 1992). Generally, most staff in health facilities lack knowledge and skills to be effective problem-solvers (Kahssay 1998). One study carried out in Portugal among health personnel and management showed deficiencies in knowledge of analysis and decision-making using HIS (Abrantes 1987). A health centre director and his staff were unable to produce a list of decisions for which they were responsible. Even regional administrators had difficulties in producing an organised list. Similar observations have been reported from studies conducted among health workers in Botswana (Maimela et al. 1989) and in Isoka district in Zambia (Siaga et al. 1993), and in primary health facilities in Nigeria (Osibogun et al. 1996).

Sandiford et al. (1992) remark that one of the factors limiting the effectiveness of HIS in many countries is the scarcity of staff trained in data analysis and interpretation, as converting data into information requires analytical and interpretative skills, and also a good comprehension of some basic epidemiological concepts. However, such skills are not always in abundance, even in developed countries (Australasian Epidemiological Association 1991). An information management review of NASCOP (1999) recommended that Provincial Medical Officers (PMOs), and District Medical Officers of Health (DMOHs) need to be trained in project management and data analysis in order to develop strategies for their provinces and districts, and also health information officers should be trained in data collection and analysis (Mordue 2000).

Despite the existence of large numbers of training programmes in epidemiology and related fields throughout the world (Sandiford et al. 1992). However, Cassels and Jonovsky (1991) caution that it is nevertheless important to realise that training is no panacea for the problems of health information systems, and probably achieves little if attention is not given to other constraints in the system. Training aims to provide employees with proficiency in the execution of a given task, but on the other hand training also entails personal involvement, commitment and experiential gains: it involves learning by doing. Equally, once a training need has been identified, the Training Manager, working closely with the other parties concerned, should decide how much time will be realistically needed to endow the employee with the new competences (Hughey & Mussnug 1997). In other words, adults learn more efficiently when they are allowed to talk about the subject and relate it to their own experiences, and discovering the usefulness of skills is not the same as being skilful.

Vital issues in training for HMIS include training and education in best practice in maintaining, managing and developing information systems, data collection, data quality, compilation and analysis, and information presentation. Other important aspects are training and education in how to use information to improve health services, and similarly training in the dissemination of information to help people understand the strategy, its component parts and the role they may play in its implementation (Mordue 2000). Equally, the training of health workers on HMIS should also address the use of information at the point of collection (Campbell et al. 1996). Even more important is that the training should be organised at different levels of staff and community, since the ability to understand and use the content of the training will vary from one group to another (Mordue 2000). Such training could be on-the-job training, sometimes described as job instruction training, in which new employees receive training while actually performing their jobs, which provides job experience under working condition, and is the most common form of training among non-professional or paraprofessional personnel (Nnadi 1997).

As Hughey and Mussnug (1997) suggest, successful employee training programmes demand a significant investment in terms of both financial and human resources. Moreover, time should be allocated based on the value placed on the skills and competence that are to be transferred through the training programme. In other words, the amount of time allotted to the training programme should be determined by factors independent of the nature of the material to be covered in the session. Another critical dimension in the development of employee training programme concerns the number of people in each individual session. Finally, it is worth mentioning that successful employee training programmes are the result of thoughtful and serious planning. A great deal of attention must be paid to details and desired outcomes. Likewise, training requires a great deal of commitment, is very time-consuming, and demands persistent, ongoing support.

2.3 Type of data collected, data handling and information transmission including feedback

Type of data collected: A thorough detailed analysis of the information requirements for the health sector at all levels is clearly needed before the full information requirement of the sector can be known (Mordue 2000). However, according to Mordue (2000), the report of a pilot study undertaken in 1999 on the HMIS Department of the NHS in Britain provides a picture, albeit incomplete, of the requirements that need to be met. For example, the strategic UK policy group indicated that it was impossible to think of any information relevant at one level that was not required in more detail at a lower level. Management information also needs to be of the right type, in the appropriate quantity, of acceptable quality and available at the right time (Moidu 1993). The type of information varies from family health and family planning service statistics to maternity statistics of antenatal and post-natal care visits, numbers and types of referrals, deliveries carried out and obstetric and neonatal complications (Moidu 1993). Other relevant information includes environmental health services, school health services, health education activities and mortality statistics, including the number of deaths_and causes of death of residents by sex, age and age group. It may also provide data on health status, although the selectivity and quality of the data may not meet the needs for thorough evaluation (Norren et al. 1989). In Nigeria, managers mentioned the importance of indicators for the prevention and control of epidemic diseases, and topographical data such as the distance to health care facility by population (Ijadunola et al. 1998).

Data handling, information transmission and feedback: In addition to the direct information needs of various stakeholder groups, there is a need for communication between the primary, secondary and tertiary levels of care (Ijadunola et al. 1998). Braa reports that in South Africa, some clinic are required to sends a 30-page booklet of raw data to the head office every week, with a copy kept on file locally, the data is transmitted in raw form, with no compilation or analysis, and there is no local use of the data (Braa 1996). The feedback from referral institutions back to primary care or to local government was almost non-existent (Ijadunola et al. 1998). This implies that where decision-making is centralised, the information system must also exhibit some centralisation, even though this may reduce its ability to detect and act on patchiness within the system. Information as such can impact on health by influencing decisions: it would seem obvious that the flow of the information system must retrace the steps of the decision-making process (Sandiford et al. 1992).

Feedback of information to the providers of health data is essential (Boerma 1991). Thus, Schware in 1987 emphasised that "success of any management information system heavily depends on feedback of the data collected". This is the backbone of a sound health information system (Boerma 1991), and ideally provides incentives for providing accurate, up-to-date data (Schware 1987). The processing of information as exemplified by Alter and Hage (1993, p. 93) entails that information system feedback is a key management mechanism in networks: it offers a communicative link between all parts of the network and provides information for goal formulation and accomplishment. These authors conclude that there are two main factors compelling networks to use large amounts of information feedback: one is that social work involves a great deal of uncertainty, which cannot always be specified in advance; and the other is the requirement for quality and customisation of services.

2.4 Quantity of data collected

Information in health care is required for more than one function (Moidu 1992). It is needed at the peripheral delivery end and also by the central administration (Moidu et al. 1998). Similarly, data may be used simultaneously for dual purposes, such as making a laboratory report and triggering the billing system. It may be used at a later period for comparison to track changes in the state of the patient, or to build the knowledge base (Moidu 1992). Thus an integrated information system addresses the multi-functional information needs of health care / hospital organisations, including administrative data needs, such as the capability to supply the care providers with knowledge-based decision support. So a large amount of data is collected (Kadt 1989, Braa 1995). Moreover, in order to obtain greater accuracy in decision-making, large quantities of quality data are required. Consequently, information requirements are greater than usually expected to provide a need based distributed primary health care service (Moidu 1992). Thus a large amount of time is often spent at various levels on collecting and processing this data (Schware 1987, Smith et al. 1987, Garner et al. 1992).

The 1997 World Health Organisation report stated that excessive recording and reporting tasks generally consume between 15-45% of the health workers' time, which is spent primarily on collection and analysis of data at the expense of service provision (World Health Organisation 1997). Similarly, in another setting nurses were found to be spending up to 40% of their time filling in forms demanded by superiors (Braa 1995). In Moidu's study, the number of registers varied from site to site, ranging between 45 and 76 at each primary health centre, with 9-12 merely to support the family planning programme (Moidu 1993). Although the frequency of reporting varies, there are as many as 100 variables in each monthly report, derived normally by collation of data from the numerous records. Consequently, the primary health workers are thus found to spend 50% of their working time on collating and compiling data. The quantity of data was magnified by non-co-ordination or lack of integration of information from the different services, absence of common goals or operational targets, and lack of indicators. Other reasons included the absence of standards for reporting and varying target populations, which meant that the data were incompatible. This in turn resulted in information duplication, with similar data being collected many times (Bagwa et al. 1994). Bagwa et al. add that at the same time there are enormous gaps in information, while much data is irrelevant to both collectors and managers. The volume of data collected is enormous, but its quality is poor and the quantity of useful information produced from it is minimal (Bagwa et al. 1994). Moreover, the demands set for the information system by programme managers are not commensurate with the attention paid to the development of the information system, and the system is therefore found to be inadequate (Moidu et al. 1998).

The other issue in relation to medical data is in terms of data content: which data should be recorded, and how much data is enough? The emphasis on data acquisition has led to data collection on a huge scale (Moidu 1993). Data collection can become a preoccupation of the primary care providers almost to a destructive extent, so much so that the process of primary care implementation assumes a secondary role (Moidu 1993). Regardless of the method of data entry or analysis, there is a need for consensus on the quantity of data that must be available in the computer-based information system of a health care organisation (Moidu 1993). In addition, the need to define an adequate minimum data set is universal (Hayes et al. in Moidu 1998). Moidu (1993) points out that in information systems that permit free text entry, there is either so much that information is omitted, or the data is inadequate. For example, one academic centre was forced to abandon the method of computerized medical records owing to the high data entry cost, and the primary factor contributing to the cost was the volume of data (Dambro et al. in Moidu 1998).

Despite technical advances in effective data management, such as the availability of more powerful hardware and increased memory that lower costs, defining the data quantity that application software must hold remains a contentious issue (Moidu et al. 1998). Moidu et al. (1998) described the core data set that is essential to support the delivery of health care programme as an *Essential Data Set* (EDS). The concept is a method to resolve the issue of defining the data quantity, as a core data set in an information system. Moidu et al. (1998) emphasise that "the effort to identify an *Essential Data Set* for management health systems will also contribute to identifying the most valuable predictor for risk"; however, an effective data collection system must first be in place preferably at multiple sites with common core data content. The idea that there may be quality in a limited data set is logical enough: after analysis of the data reporting and recording in hospitals in Europe, the concept of a Minimum Basic Data Set (MBDS) was described and a Data Set for hospitals was defined by Lambert and Rogers and later adopted by the European Community (Lambert & Rogers 1991). Similarly, Hoogendoorn (1984) demonstrated that much could be learned and derived from even a minimum basic data set.

Thus an *Essential Data Set* for a health programme or domain has been defined by Moidu et al. (1998) to include precisely as much data as is required to provide the essential foundation for decision-making by all levels of care providers and administrators who are working at any level of the health care organisation in the provision of direct or indirect care, on such matters as initiating therapeutic interventions, identifying the need for care, and monitoring and evaluating the impact of the care provided in relation to the programme concerned.

In addition, according to Moidu et al. (1998) a data element that is an *EDS* for a health programme must fulfil some of the following criteria:

- Ease of collection, preferably at the least cost
- Provision of information related to health status
- Assistance in risk and clinical assessment during encounters
- Reflection of the actions or interventions undertaken
- Assistance in assessment of outcomes or having a predictive value for an outcome and
- Reflection of the actual outcome

However, the above authors caution that these measures are not *golden standards*, but the starting point for identifying an EDS.

2.5 Data collection tools for HMIS

An information system designed as a management tool requires an enormous number of registers to be maintained. In order to collect data: tally sheets, registers and client cards are in use (Braa 1995, Manga, Eger Aryce & Agyepong cited in Campbell 1997) or alternatively forms are used to collect data (Campbell et al. 1996). As reported by Braa et al. (1995), in South Africa the tools used to collect data were simple: planning was based on goals, operational targets and a minimum number of indicators. Reporting forms with both numerator and denominator and calculated indicators are sent to supervisors (Braa 1995 cf. Campbell et al. 1996). In India, for each vertical programme there is a separate target population register, a different register for each process and encounter, and a separate register for each inventory (Nayaran & Auxilla1989).

In order to improve the Libyan health information system, a review and standardization of all forms, registers and patients files in use in all hospitals was carried out (Nayak cited in Moidu 1993). Similarly, the process of proposing revisions to the existing health information system also focused attention on the form, quality and quantity of the data needed to provide useful management information (Woelk 1993). The computerization was only carried out after the required information was clearly specified, and the data collection forms, which served also as data entry forms were designed.

2.6 Motivation of facility health workers towards data collection

Among the areas of weakness on MIS identified in Maharashtra, India, was inadequate utilisation of information by programme managers at different levels, which was mainly due to their lack of appreciation of the information generated (Narveka 1990). Similarly, experience from analysis of case studies on MIS from primary health care projects in_Bangladesh, Pakistan and Kenya found that the major problem reported in all these MISs was limited appreciation of the utility of management data at all levels (Hansen 1987). However, in Nepal, Bolivia, Senegal and Haiti, it was found that health workers and the community can manage and utilise information, but are unlikely to be willing to do this unless it is in their self-interest: this process gives them control over primary health care priorities and resources (Reynold 1987).

According to Kumar (1993), in India health workers felt that the procedure of data collection and analysis was cumbersome and time-consuming. Equally, in Pakistan the field team, while recognising the usefulness of the MIS in performing their duties, considered the burden of data collection and processing to be excessive, and failed to understand the importance of some of the information collected. The attitude in turn led to poor quality of some of the data (Husein 1993). In the mid-way report on Burkina Faso's progress towards achieving Health For All by the Year 2000, it is reported that since resources have not been adequately decentralised, there was no incentive for those in charge of units to engage in micro planning for their own areas, and as a result, the information collected for management was not utilised effectively (Sombie 1990).

2.7 Quality of data collected

Discussions of data quality are often tedious and can easily receive insufficient attention (Deaton 2002). Information system quality, in particular, is one of the most important activities in any organisation. The provision of better management for quality health care at all levels of the health care system can be effectively achieved only if there is a well organised and effective information system that can be used both to monitor the health of the population, and to provide accurate, adequate and timely information for management decision-making at every level within and outside the health sector (World Health Organisation 1997 and 1979). Nowadays information systems represent very large investments: their development, maintenance and operation require considerable financial resources (Adelakun 1999).

Although perceived quality affects health services utilisation, nevertheless quality assurance has played little role in information systems to date. At least one reason for this lies in the difficulty of establishing useful indicators of quality and institutionalising their use in health services management. If quality indicators are to be routinely collected within the health system, a major challenge will be to gain the trust and cooperation of those who will effectively be recording the data on which their own performance may be judged (Sandiford et al. 1992). Sandiford et al. (1992) assert: "understandably, in developing countries too, issues of quality, which were somehow neglected during the 80s, are now being addressed". Health information system developments will be needed to safeguard quality, for the quality of the information produced by the computerisation process is only as good as the quality of the original data fed into it (Moidu 1993).

It is necessary to have staff dedicated to compiling and analysing data for some or all of their time, but this should be primarily to ensure completeness and accuracy of information and providing feedback to lower levels. However, it has been cautioned that data will never be perfect, but great improvements to services delivery can be made without having precisely accurate figures, as it is usually the range that matters (Ijadunola et al. 1998). Studies carried out in India have revealed that data collected in vast amounts are mostly incomplete, unreliable and unused (Kumar 1993). This has also been reported by Partners for Health Reform*plus*, (2003) "generally data is of poor quality, is not transmitted in a timely manner, and is often not analysed locally before being reported to higher levels."

2.8 Facility workers' attitudes towards HMIS

One of the strongest motivations for ensuring the quality of information being collected is a personal interest in its local use. Consequently, improving the understanding and use of information by those who collect it, particularly in communities at health facilities and amongst DHMT members, contributes not only to better management but also to improving the information itself (World Health Organisation 1997). Kalowela (2001) defined workers' attitudes as "the way health workers at health facility think, feel or judge about the use of information from the HMIS". Thus those workers who considered that information from the HMIS was useful in order to improve health and health care were judged to have a positive attitude. On the other hand, a negative attitude was considered to be that HMIS is not useful in order to improve health and health care. In fact, unless staff at all levels of a primary care programme understand the importance of data they are collecting for aggregation and analysis, the value and use of the information will be neglected.

According to Nabbaro (1987), workers are inclined to develop useful information systems if they perceive that the systems are flexible and responsive, and if they perceive that they have some control over their performance. If workers cannot be convinced that such systems would be useful for their work in planning, research and feedback activities, nothing can be achieved (Nayak cited in Moidu 1993). Those who are responsible for the implementation of HMIS often fail to perceive the relevance of the data to their own work, and therefore do not undertake data management tasks with sufficient interest or motivation (Shanawongse 1987). If the need for information is recognised by those who do the work, then its usefulness will also be realised (Campbell et al. 1996). On the positive side, information systems developed with the support of a bottom-up approach are regarded as very useful by the users (Walsham 1992). WHO reports that since a "top-down" approach is unlikely to be successful, developing countries should move towards "bottom-up" approaches to decentralised information systems (World Health Organisation 2001).

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2.9 Utilization of information generated from management information systems

A well-designed routine health information system should include facility-based health workers having the capability and some sort of encouragement to use at least some of the data they report in their own facility (World Health Organisation 2001). MIS have been designed to convey reports of action, and these reports are primarily counts of activities carried out and resources used (Moidu 1992). Integration of multi-professional involvement and coordination is required in the delivery of health care services. Consequently, health information systems provide information for the management of a health programme or system and for monitoring its activities, and exist as an integral part of the health system to support the health functions (World Health Organisation 2001). For these reasons, information systems to support primary health care need to be closely connected to the working process and community interests, which are dynamic and changing.

The *lingua franca* or the medium of communication among health professionals is data/information (Moidu 1992). This means that local analysis and use of information is a crucial factor in the primary health care concept (Wilson et al. 1987). The ability to analyse and interpret data is indispensable, but insufficient to overcome the inertia of the *status quo* or to ensure that the information is translated into decision and actions (Sandiford et al. 1992). According to Butcher and others, information specialists should provide information in a form that increases usability: information products and services should be presented with the content and in the format that addresses the situational requirements of managers who influence resolution of the problem. If the information is not provided in this way it may be difficult for managers to utilise it in effective decision-making (Butcher 1977, Coiera 1997).

An additional problem is how to approach the utilisation of clinical and management health information, which remains a complex, chaotic, and controversial subject (Rodrigues 2000). In primary health care, the challenge is to analyse and use the information *immediately*, at the same level where it is collected, thus providing local information to support action (Kadt 1989, Opit 1987). The existing gap in information use is an outcome of the information system failing to address local needs or to engage staff at local level in data analysis (Bagwa et al. 1994). In this case, the HIS reflects the centralised and vertical structures, and the top-down management system hardly involves workers in data analysis or decision-making: a vicious cycle that reinforces centralisation and fragmentation. The limitations of centralised health information systems (Sandiford et al. 1992) have already been discussed, and in many settings efforts to decentralise decision-making are potentially perhaps the most effective means to increase information utility.

According to the World Health Organisation (2000), lack of awareness by health policy-makers and programme managers on the strategic importance and practical usefulness of health information for planning and management results in low demand for information. One weakness of MIS in Pakistan was that the system collected certain information not used by those providing the services, and thus providers failed to recognize its utility (Karim 1990). Similarly, there was limited use of information by managers at all levels of health care in Cambodia, Indonesia, Malaysia and Mongolia (World Health Organisation 1999). There is also no local use of data among developing countries (Bagwa et al. 1994). Management of information systems has been a major problem (Schware 1987, Smith et al. 1987, Garner et al. 1992). Campbell et al. (1996) observed that in many countries health data are not utilised; instead they remain simply part of the reporting system. For example, Segar (1992), reported that "nurses... do not decide what information is collected and they do not analyse, discuss or utilise the data, which they spend so much of their working time collecting." The waste of professional manpower, which could be utilised for the delivery of effective primary health care, is significant (King 1991).

The user role (level) is also more complex than is usual in traditional system development. Health workers, district management and communities are all users of the information system at different levels – all having different interest and relationship to the health system. In an organization with many different groups of decision-makers or information users, perceptions of the importance of information and the role of the health information system vary (Moidu 1992). Thus, Shortliffe (1991) has recommended that a medical decision-making system must be developed as an integrated part of the information management system. Similarly, donor agencies that are funding the primary health care programmes in developing countries can easily evaluate and monitor the progress of the care programme if information management tools are in place (Moidu 1993).

2.10 Information system models

Science may be viewed as the attempt to make sense of the past, present and future, which involves the search for meanings and theories. To evaluate the quality and effectiveness of scientific advice prepared and utilised by the UN and its component organisations, it is necessary to understand the meaning of scientific advice and how leading scientific organisations put it into practice (National Research Council of the National Academies 2002)

In discussions of theoretical models, Meuller (1997) suggests that the construction of models (e.g. causal models) can be divided into two parts: the easy part, which is the mathematical part, and the hard part, which is the construction of models that are consistent with sound theory. Of similar importance is theoretical philosophical conceptualisation: "Science is not common sense, and its most basic theoretical ideas and frames of reference require development through complex intellectual processes, which involve not only interpretations of observations but also theoretical and partly philosophical conceptualisation" (Cronk 2000). Despite this the Information System (IS) research community has failed to reach a consensus on the nature of its many fundamental constructs: how they are defined, what they represent and consequently how they are to be measured (Zmud 1996).

DeLone and McLean's model of 1992 (see Figure 2 below, taken from DeLone and McLean 1992) is based on a study of 180 published papers addressing the issue of information system success (and also, according to Ballantine et al. (1996) on the work of Shannon and Weaver, and of Mason). Their analysis leads them to propose an interrelated set of six success constructs which, taken together, dominate previous IS research (Ballantine et al. 1996). The six major dimensions in the DeLone & McLean (hereafter D&M) model for judging information system success are: *system quality, information quality, use, user satisfaction, individual impact and organisational impact* (Ballantine et al. 1996, cf. Seddon 1997, Turunen 2001, 2003).

Bonner retrospectively applied DeLone and McLean's model when studying the case of a small manufacturing company in difficulties with both information and its overall performance (Bonner 1995). In this article, the dimensions described by the D&M model are applied, and an additional new factor, information awareness proposed, but not added as a dimension to the model as more research was required to determine how and where it fits in. Similarly, the 3D model of information system success in Ballantine et al. (1996) is an extension of the original D&M model; these authors regard it as overcoming some of the identified limitations of the original model, and suggest it for use as a basis for research. This model attempts to improve the understanding of the concept of information success by separating *success* into three fundamental dimensions or levels: the technical development level, the development to user, and the delivery of business benefits (hence the term 3D model). Figure 3 shows the key elements of the model. Another model developed after refinement and extension of the D&M model is Seddon's (1997) partial behaviour model of IS use (Figure 4), which is a re-specification and extension of DeLone and McLean's model of IS success. Seddon's model replaces the variable called use by usefulness, and adds a new variable called user involvement. Seddon remarks that "the major problem is that D&M tried to combine both process and causal explanations of IS success in their model" (Seddon 1997).

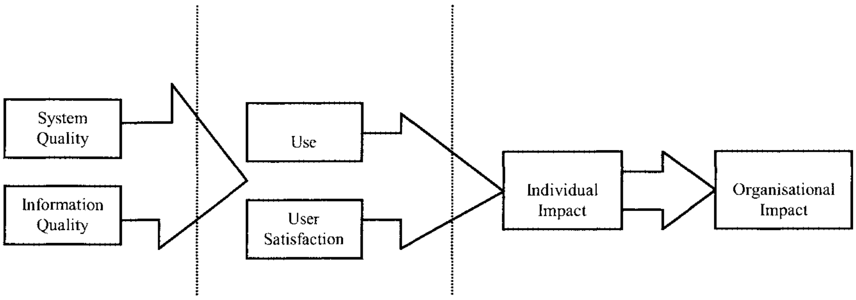


Figure 2. DeLone and Mclean's Information System Success Model

Source: DeLone and Mclean's 1992

Seddon (1997) acknowledges that DeLone and McLean's 1992 model makes two important contributions to our understanding of information system success: first, it provides a scheme for classifying the multitude of IS success measures that have been used in the literature of 180 articles reviewed, reducing them to six categories, and second, it suggests a model of temporal and causal interdependence between these categories. In fact, DeLone and McLean (1992) in their paper concluded with the comments that the model (Figure 2) "clearly needs further development and validation before it could serve as the basis for selection of appropriate IS success measures". Pitt and Watson (1994b) have augmented the D&M model and Frager and Salter (1995) also replicate Seddon's study with very similar results. Another models worthy of mention include McCall's quality model 1977, which deals with software. McCall's model has been extensively referred and was used as the basis for the first international standard for software quality measure ISD 9126 (Adelakun 1999). In addition to the models explained above, current models include Nykänen (2000) model for evaluating health information systems and Turunen's (2001) model for evaluation of the impacts of health care information systems and Turunen's (2003) framework for evaluation of medical information systems.

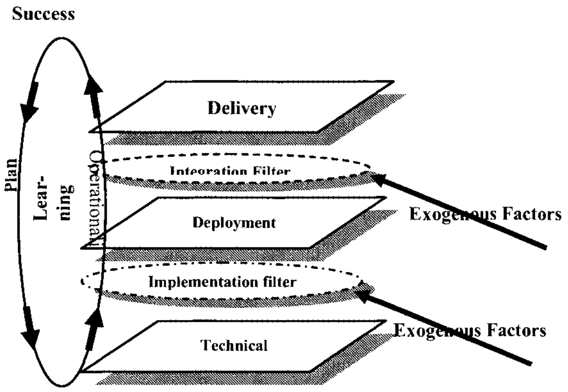
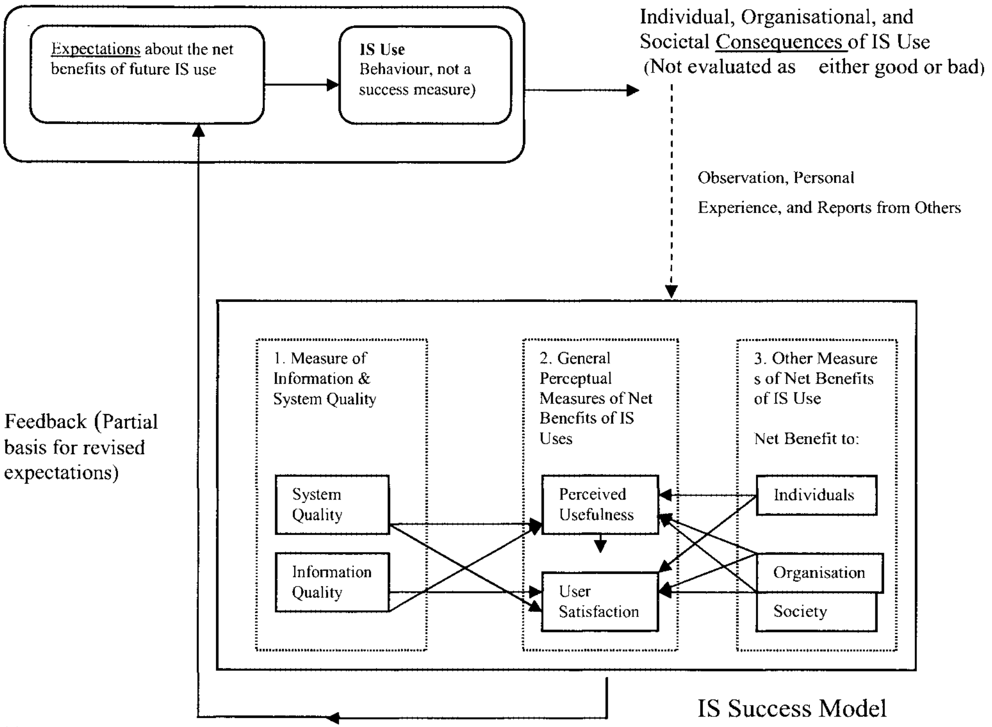


Figure 3. The 3D Model for Information System Success Ballantine et al. 1996

Turunen (2001) submits that evaluation of information systems, especially in the health care field, is a complex task. One problem is that no model had previously existed for the evaluation of the impact of health care information systems. In his view, models currently in use for that purpose are drawn from different research fields, and so are unfortunately inadequate for this particular field. The following weaknesses are cited: existing IS models are unable to describe the specific nature of the field, and they fail to recognise the difficulties of measuring impact of information systems and the need for external validity.



Key:
Rectangle boxes- IS Success model
Rounded boxes- Partial behaviour of IS Use
Solid-line arrows- Independent (necessary and sufficient) causality
Dotted-line arrow- Influence (not causal, since observer's goals are unknown)

Figure 4 Partial behaviour model of IS: A rectification and extension of the DeLone and McLean Model of IS Success Seddon 1997

3. EVALUATIVE RESEARCH THEORIES AND CONCEPTS

The current study concerns the evaluation of a Health Management Information System, and so it is relevant to devote a chapter of the study to issues that are significant for evaluation generally and evaluation research. The aim of this chapter is to provide an overview of evaluative research theory and insight on conducting evaluation research in HIS in particular. Many scholars have written on the evaluation of information systems in general, however without including a section on evaluation research theory.

The importance of the evaluation of information systems has been well documented by other evaluators. Turunen (2002) observed that as organisations become increasingly dependent on data for decision-making, the topic of information system evaluation is growing in importance. There is thus a pressing need to evaluate information systems however; there is no commonly agreed framework within which to do so. Moreover, the evaluation of management information systems is difficult because of the multidimensionality of causes and effects, and the multiple and often divergent evaluator perspectives. There are various significant issues which would justify expanding on the paradigm of evaluative research; however, for various reasons it is impractical to include a comprehensive treatment here. The time, space, effort and financial constraints are some of the many limitations on such an exercise. Nevertheless, this chapter sets out some points which from my own perspective are relevant before engaging in an evaluative study.

In view of the above, this section on evaluative research, in particular *programme evaluation,* outlines evaluative research theory as contributed by various researchers and theorists. It is however: It is however, important to mention at the start that the treatment here is not exhaustive. Thus, this chapter will comprise: *a history of evaluation research*, *definitions* of evaluative research, *reasons* for evaluation, *setting of objectives* in evaluation research, *process* "formative" evaluation, *impact* "summative" evaluation, evaluation *design*, measurement issues – *reliability* and *validity* – as well as *data collection* and *data analysis* issues.

"... While the major focus of these programmes has been overwhelmingly upon action, or the development of operational programmes and the delivery of services, the demand that some attempt be made to determine the effectiveness of such public services and social action programmes has become increasingly insistent" (Suchman 1967). "Social scientists themselves have been growing uneasy about the validity of many of the programmes being developed under the umbrella of "applied social science". The result has been a sudden awakening of interest in a long-neglected aspect of social research –the evaluation study" (Suchman 1967).

3.1 Evaluation research: the historical perspective

The evaluation of medical care services is reported to have existed from earliest times, as long ago as 3000 BC (Shortell & Richardson 1978). However, according to Suchman there was for centuries little in the way of formal evaluation of health and social sciences (Suchman 1967, Rossi & Freeman 1982). Suchman (1967) adds that the first major thrust of experimentation and evaluation of public services programmes came after the period of revolution and enlightenment in the eighteenth century. The title 'evaluative research' has largely referred to a great deal of work done in the United States on the assessment of public programmes of social change (Suchman 1967, Shortell & Richardson 1978, Veryard 1991). Early experience with many of these programmes led to awareness of the need for cost and quality control and for rigorous evaluation of programme effect (Shortell & Richardson 1978). The application of this positivist paradigm to the social realm is fraught with difficulties and has come under vigorous attack: problems of internal and external validity are detailed elsewhere (Suchman 1967, Shortell & Richardson 1978, and Legge 1984 cited in Veryard 1991).

In addition, Legge also points out those practical hindrances aside, there are fundamental epistemological objections to the view of a unitary, 'objective' social reality, but argues that even the positivist has to take on trust common-sense beliefs about the world in order to experience it at all (Legge 1984 cited in Veryard 1991). Hence quantitative testing has to depend on qualitative trusting (Veryard 1991). Veryard concedes that the belief in positivist design as the 'rational ideal' has been very strong. However, he laments the intransigencies of the research setting, which are obstacles to experimentation, and recommends the good evaluator to proceed with modified experimental design (using non-random sampling, for instance) in order to overcome these intransigencies. He takes this stand from the perspective of his paradigm. Veryard shares Legge's belief that the impediments are the reality (at least, the contextual reality) of evaluation research, and that positivist designs which seek to shield the causal process of a study from buffering by 'practical realities' during implementation render unreal any inference drawn from their evaluation (Veryard 1991). Much work on evaluation came after World War I when programmes continued to expand (Suchman 1967, Shortell & Richardson 1978, and Rossi & Freeman 1982).

Evaluations have been observed to suffer from a variety of deficiencies (Suchman 1967, Weiss 1972). In awareness of the many shortcomings, in recent times, and in particular since the mid-1960s, explicit remedial attempts have been made (Shortell & Richardson 1978). Such remedies include the training of researchers (academicians), as well as of facilitators and users of evaluation (programme administrators and planners, agency officials, and direct providers of care). Differences of opinion exist on the results of such training (Shortell & Richardson 1978). However, Shortell and Richardson (1978) summarise as follows: better and broader-based training is a necessary but not a sufficient condition for better programme evaluation. In addition, Weiss (1972) suggests that more rigorous methodological tools and designs focusing on impact or outcome evaluation may not be the solution to better programme evaluation. Rather, what is needed is a better understanding of specific programme components and the process by which they are implemented. A previous understanding of both the Tanzanian health care system and management information systems elsewhere than in Tanzania was crucial to the researcher before engaging on this particular study.

Suchman cautions that it must be remembered that the period during which these evaluation schedules were being developed was one of intense public service activity in the field of health, education, and welfare. Any critical review of these efforts to produce useful evaluation guides should keep in mind this historical perspective (Suchman 1967).

3.2. Defining evaluation research

Along with many other terms such as quality, assessment, and evaluation, to name but a few, the term "evaluation research" perhaps admits of no unique definition. As noted by Suchman (1967), the term evaluation research is restricted to the utilization of scientific research methods and techniques for the purpose of making an evaluation. Shortell and Richardson (1978) define evaluation as the use of scientific methods to isolate the causes of a particular event or the outcome of a programme, but others define evaluation research differently. For example, Rossi and Freeman (1982) give a simple definition of evaluation research as the systematic application of social research procedure in assessing the conceptualisation and design, implementation, and utility of a social intervention program.

The existence of different definitions of evaluation research has an impact on the whole process of executing evaluation research studies. Some differences are disclosed below under the subject of reasons for evaluation. In fact the different reasons for conducting an evaluation or evaluation study are one reason for the existence of various definitions. Suchman cautions that "more serious than this loose definition is the absence of any clear-cut understanding of the basic requirements of evaluative research." One finds all kinds of studies, even those failing to meet the criteria for evaluation research, being classified as evaluation research. Such studies include statistical records, inventories, surveys, testimonials and experiments. As a consequence of this shortcoming, the field of evaluative research is notable for its lack of comparability and cumulative findings (Suchman 1967).

In awareness of the divergence in meaning, there is a clear need to assess how the term evaluation is used, and the techniques for conducting evaluation research, using a more organized approach. As noted by Suchman, the American Public Health Association offers the following conceptual *and* operational definition in its "Glossary of Administrative Terms in Public Health" (American Journal of Public Health, vol. 50, Feb, 1960, cited in Suchman 1967): evaluation research is "the process of determining the value or amount of success in achieving a predetermined objective". It includes at least the following steps: formulation of the objectives, identification of the proper criteria to be used in measuring the success, determining and the explanation of the degree of success, and recommendation for further programme activity. Suchman further explains the key concepts in the definition "the value or amount of success" and "predetermined objective" (Suchman 1967, p. 28). According to Friedman and Wyatt (2000) the term "evaluation" describes a wide range of data collection activities designed to answer questions ranging from the casual to the more focused.

The Sub-committee of Evaluation of Health Activities of the National Advisory Mental Health Council of the United States also stresses the distinction between evaluative and basic research as follows: "Evaluation thus connotes scientific method, but has characteristics that distinguish it from that type of research whose objective is the accomplishment and analysis of data in order to formulate hypotheses and theory for the sake of new knowledge itself, irrespective of judgement of the value of the knowledge" (Evaluation of Mental Health US Department of Health, Education, and Social Welfare, Public Health Service, Publication No. 413, Government Printing Office, Washington, 1955, cited in Suchman 1967).

Additional, evaluation research definitions with emphasis on effectiveness are given by Øvretveit (1988) others definitions according to different authors are explained by Suchman (see also Suchman 1967, p. 28). Adelakun's (1999) use of the term for investigating information systems in organisations so as to justify their validity, reveals a paucity of both conceptualisation and scientific research on the effectiveness of most activities in these areas. Suchman summarises that while very few discussants attempt to formulate conceptual definitions, almost all offer operational definitions in terms of either what the evaluation is trying to do or how it proceeds. This means that a study is being evaluated by its purpose or its method. The same arguments are well explained by Friedman and Wyatt (2000, p. 20). They cite and extensively elaborate the definition given by Rossi and Freeman (1989), that evaluation is the systematic application of social research procedures to judge and improve the way information resources are designed and implemented, and that adopted from Guba and Lincoln (1981), that evaluation is the process of describing the implementation of information resources and judging their merits and worth. However, since evaluation and evaluation research differ significantly, there is a need to clarify the distinction between them.

3.3 Evaluation research versus evaluation

The difference between "evaluation research" and "evaluation" is another critical issue. The term *evaluation* refers to the social process of making judgment of worth, or in its more common-sense usage as referring to the general process of assessment or appraisal of value (Suchman 1967). As stated earlier, the term evaluation is often poorly defined and improperly used. This has resulted in wide disagreement, with many other terms such as "assessment," "appraisal", and "judgement" often used interchangeably with evaluation. In addition, while evaluation implies some logical or rational basis for making such judgements, it does not require any systematic procedure for marshalling and presenting objective evidence to support the judgement. In this respect, "evaluation" becomes an adjective specifying a type of research. The major emphasis lies on the noun "research," and evaluative research refers to those procedures for collecting and analysing data, which increase the possibility of "proving" rather than "asserting" the worth of some social activity (Suchman 1967). Friedman and Wyatt (2000, pp. 21-23) also provide extensive literature on evaluative research and evaluation.

Moreover, evaluative research differs from non-evaluative research in various perspectives. Shortell and Richardson (1978) point out that programme evaluation is not unique in the use of the scientific method to arrive at judgements. Rather, the scientific method and its approximations are at the core of most basic or *non-evaluative* research designed to contribute to disciplinary knowledge in various academic fields. According to Suchman (1967), evaluation studies of actions or service programmes are by and large notably deficient in both research and execution. Moreover, the difficulty of applying the principles and techniques of scientific research to evaluation studies result from both logical and administrative factors. It is further argued that much of the confusion and controversy over evaluation today may be traced to a failure to recognise certain inherent differences between the objectives and research conditions of evaluative as opposed to non-evaluative or so called "basic research" (Suchman 1967). Thus the distinction between the two lies not only in the objectives and method used but also even more in the use of the knowledge acquired. For a better understanding of the problem, the main logical distinctions as summarised from various scholars are set out in Panel 1 below.

Panel 1. Distinction between evaluative and non-evaluative research

Evaluative research	Non-evaluative research
. aims at achieving some practical goal[1] . emphasises judging the value of a specific programme or project whose results are to be used by different actors to improve, extend, modify or discard it[1] . attempts to utilise the scientific method for the purpose of assessing the worthiness of an activity[1] . tests the practical value of some action programme[5] . aims at testing the application of knowledge [1,2,3] . attempts to adhere as closely as possible to the canons of scientific method in its research design and data collection procedure [2] . degree of confidence determined by the scientific criteria plays a large role[1] . must be constantly aware of the potential utility of the findings[1] . leads to the development of *taxonomies*, and *explanations*[7] . the observable and measurable indices are *the* phenomenon of interest[8]	. aims to contribute to disciplinary knowledge and understanding of some social or physical phenomenon in a way that may or may not be directly useful[1] . searches for new knowledge, or the proof or disproof of a hypotheses[1,5] . aims at formulation of theoretical generalisation or abstract prediction[1] . no administrative action is usually contemplated or need follow . the major "success" of a basic research project lies in the scientific validity of its findings[1] . emphasises the study of the inter-relationship of variables rather than the ability of man to influence these inter-relationships through controlled interventions[6] . the primary variable of interest is the concept . can be translated into observable units, their value derives from their ability to represent this concept reliably and validly[8]

[1]Suchman 1967, [2]MacMahon et al 1961, [3]Fleck, 1963, [4]Alvin, 1957, [5]The Sub committee... 1954, [6]Hyman et al, 1955, [7]Zetterberg, 1963, [8]Hovland et al, 1949 *(Note: [2, 3, 4, 5, 6, 7] and [8] are not in the reference list as they are all sourced from Suchman 1967).*

3.4 Reasons for evaluation research

The call for evaluative research is multifaceted, coming from the public, the government, private entrepreneurs, the evaluators, funding agencies and service providers as well as from users. Equally, critics of public services and social services and social action programmes in almost all areas have joined the cry for evaluation research. Suchman (1967) cites reviews of programmes in such diverse fields as juvenile delinquency, mental health, public health, parent education, and college education, as well as medical care in the late fifties and social casework in the late sixties as objects of evaluation.

In modern times the development of new technology and technological equipment make it essential to carry out evaluations of some kind. Guyatt et al. (1986) caution that "health care is continually presented with new modes of diagnostic; treatment; rehabilitation and patient management... some have been incorporated into clinical practice without rigorous evaluation". They acknowledge that while some new technologies have clearly done more good than harm, and others more harm than good, the effectiveness of many technologies remains unclear. Henceforth, in their recommendation, in order to strike the most favourable balance between the health benefit and the cost, it is necessary to subject new health care technologies to rigorous clinical and economical scrutiny before they become widely disseminated within the health care system (Guyatt et al. 1986).

For example, it has been noted that the potential use of information technology as a competitive weapon has become a cliché; but there is still a lack of understanding of the impact of computer-based information systems in organisations, and of the processes that will allow a smooth coordination of IT and corporate strategy (Bakopoulos & Treacy 1985). As a result, the capacity of many businesses to assimilate and apply IT lags far behind the available opportunities (Parsons 1983). There is thus a pressing need to evaluate information systems (Veryard 1991). In addition, like any complex, time-consuming activity, evaluation can serve multiple purposes (Friedman et al. 2000). Friedman and Wyatt go on to outline five major reasons why we evaluate clinical information resources as follows:

- Promotional reasons
- Scholarly reasons
- Pragmatic reasons
- Ethical reasons and
- Medico-legal reasons

In principle, one or more of these factors motivates every evaluation study. Moreover, awareness of the major reason for conducting an evaluation often helps to frame the major questions to be addressed, and to avoid disappointments that may result if the focus of the study is misdirected.

Thus, at the same time, the current emphasis on cost-effectiveness in health care is creating new pressure on organisations to justify expenditures through detailed evaluation of the impacts of new information systems (Veryard 1991, Anderson 1994). Yet in various fields, especially in developing countries, public programmes are still designed, implemented and terminated without any evaluation being carried out.

According to Shortell and Richardson, other reasons for the increase in evaluative research, especially in the fields of health and social science programmes, are first, the general increase in the complexity of social life... second, investigative tools are needed to provide information... and third, the dramatic growth in service industries which cannot be evaluated solely using market mechanisms (Shortell & Richardson, 1978). Perhaps the answer to "why evaluate" in particular issues surrounding programme evaluation might not be so obvious; however, there are concrete reasons why evaluation is so important. As explained above, these could arise from the organisation, the individual programme administrator, the funding agency, the public, or the programme evaluator as well as from the service consumers. The major aim of evaluation research is to improve the efficiency of programmes in terms of their cost per unit of impact (Rossi & Freeman 1982). This particular study is evaluation for multiple purposes, of which the most important is the academic: to assess whether the approach used to put the system in place is functional, and to assess the overall implementation of the MIS. A second reason lies in the fact that many programmes, not only in developing countries but also even in the developed world, remain unevaluated especially in respect of knowledge generation and use of the knowledge found. As mentioned in the introduction, the Health Management Information System in Tanzania needed the kind of evaluation that would also produce suggestions for improving its implementation.

Apart from the different reasons for evaluation research, it is useful to distinguish between three major classes of evaluation research (Rossi & Freeman, 1982). These are: first, analysis related to the conceptualisation and designs of interventions; second, monitoring of programme implementation and third, assessment of programme utility. Evaluations that cover all these classes can be termed comprehensive evaluations. Furthermore, an evaluation research programme must be tailored to the stage of development of the intervention being addressed, as is the case with the multidimensional model proposed here for evaluating health information systems.

There exist extensive viewpoints on each perspective, but it would lie beyond the scope of the current study to go into details. Nevertheless, understanding these perspectives is crucial to programme evaluators, as they draw attention to the issue that for any single evaluative study the goals, aims, or motivation of the various parties involved are unlikely to be in accord. In addition to divergent reasons for evaluation, similarly the perspectives of different evaluators may differ in varying degrees about (i) the objects of the evaluation, (ii) the type of evaluation to be conducted, (iii) the research design to be employed, (iv) the relevant measures of programme input, process, and impact, (v) the collection of data, (vi) the analysis of data, (vii) the inferences to be drawn from the data, and (viii) the use to which the findings are to be put. Similarly it can be noted, although this is seldom mentioned, that programme evaluation can play a role in training staff and, by this process, introducing change into the organisation. The latter comment relates to statements made separately by two chairpersons when winding up focus group discussion (FGD) sessions of this study: "this group discussion has acted as a refresher and reminder to facility workers on issues on health management information system implementation".

3.5 Criticisms of evaluation research

Evaluation research has been criticised in many ways and from many perspectives, although most critics of evaluation today conclude that too few evaluation studies are being made, and furthermore, those that do exist are generally of low quality (Fook et al. 1999). Fook and others (1999) caution that another danger in evaluative research is the lack of clarity as to the purpose and of the expected outcomes from the research, which can lead to the difficulties that can be encountered when interviewing within social service organisations. They suggest that if one is to be successful in carrying out evaluative research, one must be explicit about the purpose of the research and the purpose of the interviews and the use to which the data will be put (Fook et al. 1999).

3.6 The process *(formative)* evaluation

Setting-goals and identifying objectives in evaluation research: As with any other research, conducting evaluation research implies the employment of certain processes which need to be adhered to if the evaluation is to be true to its aims. There exist a variety of perspectives on the issue of evaluation processes. According to Rossi and Freeman (1982, 1989, 1993), social interventions can be developed further in relation to their goals. Moreover, for evaluation purposes, goal setting must lead to the operationalisation of the desired outcome, i.e. produce a statement that specifies the condition to be dealt with and establishes a criterion for success. Unless these goals are operationalised into specific objectives, it is unlikely that a plan can be implemented to meet them. Nevertheless, they recommend that goals and operationalised objectives must be kept distinct.

According to Shortell and Richardson (1978), the specific objectives, the delineation of all the elements in the programme evaluation process, and the identification of the specific category of evaluation are crucial. Moreover, in simpler terms, programme evaluation can be sub-divided into three basic stages: namely (i) the specification of programme objectives (the programme planning stage), (ii) the organisation of resources to carry out the programme (programme implementation stage); and (iii) the assessment of programme performance (the programme impact stage). These three stages are crucial for the evaluation process, and will be briefly expanded. Suchman (1967), on the other hand, describes six stages in his evaluation process as follows: value formulation, goal setting (objectives), goal measuring (criteria), identifying goal activity (programme planning), putting goal activities into operation (programme operation), and assessing the effects of this goal operation (programme evaluation).

From the explanation above, it is clear that there are some differences between Suchman's approach and that of Shortell and Richardson in setting goals and objectives. Nevertheless, basic all-important principles of evaluation are followed in both approaches. This particular study devoted much consideration to identifying the goal for the evaluation, setting objectives and formulating questions according to the primary intention of the information system as well as according to the health care delivery system in the country concerned. This has made it feasible to follow up the steps from design and development to how the data is collected and utilised at different hierarchical levels. In this way it was possible for this study to come out with a theoretical framework for evaluating information system as well as analysing other variables of interest.

Suchman (1967) clarifies the reason why little is known about the evaluation of many health care programmes: the right questions are frequently not asked in the first place. He emphasises that there is no more important task for programme administrators, providers of care, policy-makers, and evaluators than to specify in clear, precise, and measurable terms the programme objectives to be accomplished. Weiss (1972) refers to this process as "formulating the questions". He sets out the technique for writing objectives in health programme evaluation: "strong" verbs (action-oriented verbs) must be used, stating only one purpose or aim, specifying a single end product or result.

Weiss (1972) has also summarised some general strategies evaluators can use to aid people in specifying objectives. In addition, objectives may range from the general to the very specific, and one may hypothesise an unlimited universe of objectives and sub-objectives corresponding to the various steps or actions that make up a total programme (Suchman 1967, Shortell & Richardson 1978). Objectives must first be selected (by all parties) independently of the extent to which they can be measured, and thereafter the process of developing operational indicators can proceed.

Shortell and Richardson (1978) suggested a framework of descending order of objectives beginning with the idealised objective and ending at the lowest level. Suchman (1967) prefers the order from immediate to ultimate or, in current terminology, from lower to higher order objectives, with a sub-division of administrative tasks. What Shortell and Richardson call 'objectives', Weiss calls input variable and "programme operation" variables (Shortell and Richardson 1978). Suchman's framework also falls under one of a number of important dimensions of programme objectives: (i) the nature or content of the objective, (ii) the ordering of objectives, (iii) target group, (iv) short-term versus long-term effect, and magnitude of effect, (v) stability of effect, (vi) multiplicity of objectives, (vii) interrelatedness of objectives, and (viii) importance and unintended or unanticipated "second order" consequences (as listed by Suchman 1967). According to this framework, the division of labour in an organisation is such that the technique or method of work being used at any level becomes the objective of the immediate lower level (Suchman 1967).

3.7 Evaluation Designs

Study design in an evaluative study follows after the statement of the problem and formulation of hypothesis (Suchman 1967); the design determines the collection and analysis of data. Difficulties in evaluation are the determining factors in the application of any formal methodology, and must be addressed if the process of evaluation is to be understood (Symons & Walsham 1991). Numerous research methods are in existence to support investigation (Anderson et al. 1994, p. 18), and different evaluation objectives require different methodological approaches.

In this respect, evaluators and researchers must choose a paradigm (Shaw 1999, see also Friedman and Wyatt 2000, pp. 225-247). But it should be asked whether there is an inherent paradigm conflict in subscribing to the worldview of one approach while employing the method of another (Shaw 1999). Lincoln answers eloquently in the affirmative: "The adoption of a paradigm literally permeates every act tangentially associated with inquiry, such that any consideration even remotely attached to inquiry processes demands rethinking to bring the decision into line with the world view embodied in the paradigm itself" (Lincoln 1990, p. 81).

In evaluative research, as in any other (non-evaluation) research, different types of research designs exist (Suchman 1967, Anderson et al. 1994). The latter recommend qualitative design for evaluating information systems: "qualitative methods typically are used to understand the perception of an information system by its users and the context within which the system is implemented or developed" (Anderson et al. 1994 cf. Kaplan et al. 1994). Thus questions such as 'what', 'how' and 'why' dominate. Much consideration has been given to design in executing this particular study, in which a combination of methods has been used, although the qualitative approach dominates.

According to Shortell and Richardson (1978), designs range from one-shot case study (X O) to one group pre-test-post-test (O_1 X_2), and static group comparison (X O_1/O_2). Campbell talks of 12 experimental designs, categorizing them in three groups: (1) *Pre-experimental designs,* which include (i) one shot case study, (ii) one group Pre-test-Post-test, and (iii) static group comparison; (2) *True experimental designs,* consisting of (i) Pre-test-post test control group design, (ii) Solomon Four-Group design, and (iii) Post test-only control group design; and (3) *Quasi-experimental designs* comprising (i) time series design, (ii) equivalent time sample design, (iii) equivalent materials samples design, (iv) non-equivalent control group design, (v) counter-balanced designs and (vi) separate-sample pre-test-post test design, which by itself has four sub-classes. In this particular study, considerations of design were foreseen in many ways, and the design itself was determined after taking into account the type of the study, the type of respondents to be included in the study, the anticipated results and also funding and time availability.

The scientific significance of a particular design is determined by its validity and reliability. It is therefore relevant to make clear the distinction between internal validity and external validity as well as between validity and reliability. As Suchman (1967) points out, confusion between validity and reliability underlies much of the heated debate over the "invalidity" of evaluative research or the "uselessness" of basic research. The measurement of the reliability, validity and differential effects of a programme requires specification according to four major categories of a variable: (i) component parts or processes of the programme, (ii) the specific population or target group reached, (iii) the situation or conditions within which the programme occurs, and (iv) the differential effect of the programme. Reliability and validity are mentioned as creating measurement problems similar to those of operational indices for non-evaluation research (Suchman 1967). Here follows a definition of the two major methodological concepts, reliability and validity, used to measure criteria of effectiveness.

Reliability: the importance of reliability is generally acknowledged by statisticians and epidemiologists and accorded first place by the World Health Organisation among a list of research requirements (Suchman 1967). In this respect every study should make provision for reproducibility of tests of a selected type (instruments such as questionnaires, checklists, equipment etc.), on samples of subjects (human, specimens etc) throughout the study. Thus the reliability of a measurement refers to the degree to which this measure can be depended upon to secure consistent results upon repeated application (Suchman 1967, Shortell & Richardson 1978, Friedman & Wyatt 2000). The stability of an intervention over time, the quality control of intervention and the care taken are considered as measures of reliability (Gould 1994).

Of great importance in reliability is that it is a necessary but not sufficient condition for validity (Suchman 1967, Shortell & Richardson 1978) and so there can no be validity without reliability. For example "an evaluative measure which cannot be depended upon to give the same results upon repetition because of large random errors obviously cannot be used to measure anything and therefore cannot have any validity" (Suchman 1967 cf. Shortell & Richardson 1978). However, a reliable measure may still have low validity: that is, although the measures are consistent, they do not use the right criteria (Suchman 1967, Shortell & Richardson 1978). In support of this Friedman and Wyatt (2000, p. 90) state that we cannot even discuss the validity of a measurement process until we demonstrate it to be reasonably reliable.

In addition, a few points about reliability which are relevant to evaluation research deserve mention: as documented by Suchman (1967), in this sense the "true" value of the measurement is itself subjected to a range of variability and a "reliable" instrument should indicate this variability (Suchman 1967). The variation of blood pressure measurement results under different circumstances illustrates how the use of a reliable instrument does not necessarily lead to valid results (Ryynänen 2003). There are other important issues as pertaining to reliability, such as types and methods of assessing reliability, as seen in Panel 2 below. However, detailed explanation is beyond the scope of this study (see also Suchman 1967, Shortell and Richardson 1978)

Panel 2. A summary of reliability assessment methods

Measurement method	Time interval	
	Same point in time	Different point in time
Observers, raters	Inter-rater or inter-observer reliability; correlate judgement made by different observers at same point in time "Objectivity reliability" (A)	Inter-raters and inter-observer reliability; correlate judgement made by the same person at different point in time "Precision reliability" (B)
Tests, questionnaires, surveys	Split-half reliability; Short-form vs. long-form; Internal consistency reliability "Congruence reliability" (C)	"Test-rate reliability" (D)

Source: Shortell and Richardson (1978, p. 76)

Validity: Suchman concedes that validity is the single most important methodological criterion for evaluating any measuring instrument, whether evaluative or non-evaluative: "the problem of validity invades every aspect and every detail of the evaluative process, especially the selection, definition, and application of the criteria" (Suchman 1967). Validity refers to the degree to which any measure or procedure succeeds in doing what it purports to do (Suchman 1967, Shortell & Richardson 1978, Ryynänen (2003). It reflects those errors, which are systematic or constant. If systematic, these errors must represent some form of "bias", which slants the result in a particular direction rather than at random (Suchman 1967, Friedman & Wyatt 2000, Ryynänen 2003). In this case the factors affecting the validity of the result may therefore be viewed as "causal" and may constitute an important source of analysis. In many ways, validity is achieved in qualitative evaluation through transparency in setting out the process of inquiry (Altheide & Johnson 1994).

Since validity is affected by bias, and since bias may occur at any and all stages in evaluative research process, the problem of validity can exists in the following forms at any stages of the entire operation of an evaluative research project, in the following forms: (i) propositional validity, (ii) instrument validity, (iii) sampling validity, (iv) observer or evaluator validity, (v) subject validity, (vi) administration validity, and (vii) analysis validity.

Suchman (1967) distinguishes four types of validity criterion: (a) face validity, (b) consensual validity, (c) correlation or criterion validity, and (d) predictive validity. Shortell and Richardson

(1978), however, mention five types of methods for assessing validity, namely: (a) face validity, (b) content validity, (c) concurrent validity, (d) predictive validity, and (e) construct validity. With the exception of criterion validity, which is not mentioned by Suchman, the rest carries similar validate measure (Shortell and Richardson, 1978).

Internal validity has been described as the crucial question or the true value: were prediction outcomes made, and were they confirmed? Are the findings judged to be true by the participants, including service users? Also, was negative evidence actively sought, and have alternative explanations of events been considered and tested against the evidence? (Gould 1994) According to Suchman, internal validity refers to the relationship, which the measure being measured has with certain other measures, from the face validity of logical reasoning to the predictive validity of a specific feature event, while external validity concerns the relationship between the tested measure and an external criterion. One example is the comparison of measures such as age: comparing how old a person says he is with his birth certificate (Suchman 1967). External validity considers the generalisation of findings to other contexts (Gould 1994) and refers to the relationship between the test measure and an external criterion. The better this external criterion can be predicted, the more validity can be attributed to the test measure (Suchman 1967).

Kjerulf concludes that the qualities that need to be adhered to in evaluative research in the choice of a study design will depend on financial constraints, how quickly questions must be answered, and the extent to which the researcher is free to experimentally manipulate specific interventions (Kjerulf 1994). Great attention has been paid to issues of validity and reliability in the present study: Chapter 5 describes how reliability and validity issues were controlled, and further discussion on validity and reliability is provided in Chapter 7.

3.8 Impact *"Summative"* evaluation.

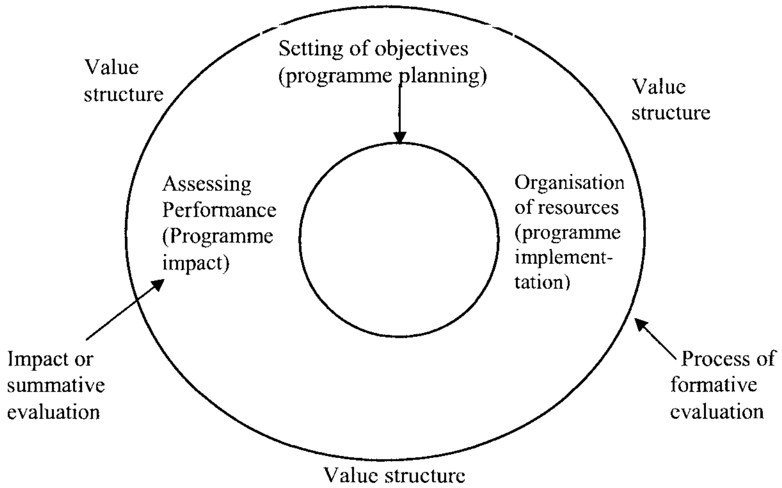


Figure 5. Evaluation cycle Source: Shortell & Richardson 1978

3.9 Data collection in evaluative research

Data is the source of information: to produce meaningful information, data of high quality must be collected. However, collecting data of high quality that will produce meaningful interpretation is painstaking and requires an appropriate method as well as well-trained and motivated personnel. There is an abundance of literature available from different fields and perspectives to help make this a reality. Different paradigms as explained above collect or recommend different types of data, and use different methods to collect and analyse data. However, the discussion here will be limited to qualitative and quantitative methods of collecting data. Rossi & Freeman (1982) dispute that whether the data collected should be qualitative or quantitative is a separate issue. He makes clear that quantitative data can be defined as observations that readily lend themselves to numerical representation, such as answers to structured questionnaires, pay records compiled by personnel offices, counts of speech interaction among co-workers, and the like. In contrast, qualitative data, such as protocols of unstructured interviews and notes from observations, tend to be less easily summarised in numerical forms. Although the two techniques can be used separately, when used in combination they gather data of high quality.

According to Kaplan et al. (1994), the qualitative evaluator uses three main sources of data: (i) observation, (ii) open-ended interviews and survey questions, and (iii) documents and texts. One among the three is also suggested by Patton (1980) in to which can be subsumed questions about standards in evaluation is whether data of high quality have been carefully collected and analysed in terms of reliability, validity, and triangulation). Qualitative methods give a wide range of coverage, which is of great importance for the present study (see combined methods sub-section 5.2.3). It is considered that the most important principle of qualitative data collection is that everything is potential data (Kaplan et al. 1994). In addition the evaluator does not rigidly restrict the scope of data collection in advance, nor use formal rules to decide that the some data are inadmissible or irrelevant.

The qualitative approach to validity is to use all *relevant* data but to use them critically "... the evaluator must continually make decision over the course of the project, must work to focus the data collection process but not to focus so narrowly as to miss or ignore data that would contribute important insight or evidence" (Kaplan et al. 1994). According to Rossi (1982), comparisons between the two types of data focus on numerical representativeness, difficulty of collection, costs and time of collection of data, and uniformity of information collected across all cases and all situations. The relative advantages and disadvantages of the two types of data have been debated *ad nauseam* in social science literature (Cook and Reichardt 1979). Rossi and Freeman (1982) concede that we cannot resolve the debate surrounding data preference, and concludes that qualitative observations have an extremely important role to play in certain types of evaluative activities, particularly in the monitoring of ongoing programmes.

In realisation of the strengths and weaknesses of these methods for data collection, I decided_to combine qualitative and quantitative methods so as to enrich the quality of the data for this particular study was taken. With this in mind, it was crucial to choose a method that would generate data that would reflect the situation being evaluated. This issue will be followed up in chapter seven.

3.10 Data analysis in evaluative research

The necessary first step in data analysis, prior to all subsequent techniques, consists of reading the data (Kaplan et al 1994). Reading of the data is done to gain familiarity with what is going on and what people are saying or doing, and to develop initial ideas about meaning of these statements and events and their relationship to other statements and events. Thus descriptive statements might take the form of narrative accounts, especially when monitoring data derived from more than one qualitative source.

Kaplan et al. (1994) argue that developing coherence and order in the research is one of the basic goals of data analysis. The purpose is to develop an understanding or interpretation that answers the basic questions of what is happening in an inductive and repeated manner. Usually data collection in a qualitative method cannot be precisely specified (Kaplan et al 1994). Agar describes the process for data analysis as follows: " 'You learn something' (collect some data), then you try to make sense out of it (analysis), then you go back and see if the interpretation makes sense in light of new experience (collect more data), then you refine your interpretation (more analysis) and so on. The process is dialectic, not linear" (Agar 1980). Other scholars conclude that of great utility are quantitative analyses, for which increasingly sophisticated analytical methods and measures are being developed (Miley et al. 1978, Heumann 1979).

Developing coherence and order in the research is one of the basic goals of data analysis (Kaplan et al. 1994). Usually neither data collection nor data analysis in the qualitative method can be precisely specified. Agar describes the process as follows: " 'You learn something' (collect some data), then you try to make sense out of it (analysis), then you go back and see if the interpretation makes sense in light of new experience (collect more data), then you refine your interpretation (more analysis) and so on. The process is dialectic, not linear" (Agar 1980).

4. AIM OF THE STUDY

The aim of this study is to evaluate the Health Management Information System in Tanzania, which was introduced countrywide between 1994 and 1997. To fulfil this task the following four main aims, which included sub-aims, have been established.

4.1 Specific Aims

1. To evaluate the development of the Health Management Information System by identifying the types of routine health data collected at the primary health facilities and also data processing and transmission
2. To examine the quantity and quality of data collected by evaluating different tally sheets, forms and registers used to collect data at the primary and secondary health facilities, and by assessing the knowledge of health facility workers on data collection, primary facility workers' motivation by salary, and the attitude of workers towards the information system.
3. To examine information utilization in primary health care.
4. To develop a theoretical model for health management information system evaluation.

5. METHODS AND MATERIALS

This evaluative study, which evaluates the design and development of the Health Management Information System, was conducted in the United Republic of Tanzania. The study involved primary, secondary and tertiary levels of health care delivery. Dispensaries and health centres make up the primary level, district and regional health offices comprise the secondary level, while the tertiary level consists of the referral hospitals and the ministry of health. Health workers at different levels of health care delivery collect and compile routine health data using the HMIS, which is known as MTUHA in Kiswahili. This study principally dealt with data collected at the primary level. All health data collected from primary health care are manually compiled and submitted to the next (secondary) level, the district health office. Districts submit data in manual or computerised form to the regional health offices (another secondary level, see Figure 1 in section 1.4.3.3). All data received by the region from the districts is aggregated before being transmitted to the HMIS unit, which is located in the Department of Policy and Planning at the Ministry of Health. Data transmission to the unit is in the form of hard copy, floppy disk or electronic mail. Along with the hierarchical data transmission, every level is responsible for making appropriate decisions from the information received according to its capability to deal with the issue at hand. However, in the absence of capability to solve the problem at hand, assistance is sought from the level above.

Three components are encompassed in this evaluative study. The first component involves describing the HMIS from the time of its design and development to the actual implementation. The description fits well into the description of the health care system in Tanzania from the colonial time till the present given in the Introduction. The descriptive part of the information system is mainly based on available literature and the empirical part of this study. In order to supplement the information obtained, interviews with some officials at the ministry of health (MoH), in particular at the HMIS unit, were undertaken. It was foreseen that some of the information could not be obtained in official records. The problem of data and information storage is global, so that interviews remain a major way of collecting data and information. Close collaboration with the staff at the MoH (HMIS unit) and elsewhere was important to fulfil this task, and to obtain data of high quality.

The second component of the study centres mostly on the pragmatic part. This component involved data collection from respondents in selected primary health facilities, district and regional health offices and at the HMIS unit. Data collection at these levels was achieved by interviews to administer questionnaires, question guides for focus group discussions and in-depth-interviews, and use of a checklist. In addition, some photographs were taken at primary and secondary levels.

The third component consists of the development of a model for health information system evaluation. This model, a multidimensional model for health information system evaluation, entails step-by-step development of the information system in Tanzania together with assessment of additional variables: quantity of data, quality of data, and use of information and transmission and feedback of information.

5.1 Sampling procedure

The sampling procedure explained here is in conformity with the research proposal submitted in May 1999 and accepted in June 1999 by the Faculty of Social Science of the University of Kuopio, Finland. Thus, conformity and uniformity have been maintained throughout the study in relation to the initial design. Conforming and maintaining the initial design builds up trustworthiness and enhances the validity of the data collected and the study as a whole. Scott-Samuel et al. (2001) suggest that it is important to distinguish between procedure and method for selecting the parameters of interest. Moreover, procedures are frameworks, while methods are ways of implementing the framework (procedure). It is therefore important in this study, after explaining the procedure used for sampling, to elaborate on the methods used for each step: health facility, districts and region, and also ministry of health. These steps were crucial to safeguard the selection procedure and ensure reasonable sample sizes, enabling the suggestion of valid generalisations across levels.

5.1.2.1 Purposive sampling

In this study, purposive, also known as judgemental or theoretical sampling, was used to obtain one region among twenty-five regions of the United Republic of Tanzania. The most essential reason for using purposive sampling, in accordance with existing literature, was to enable the principal investigator to have access to logistic and other necessary backing from the regional and district health administration (his own working area). In addition, the management information system had been pilot-tested and initiated in this particular region. The time limit for data collection was also taken into consideration. Other reasons for purposive sampling in conformity with existing literature are set out below.

According to Chadwick et al. (1984) “purposive sampling is carried out with the basis of the researcher using his expertise to select the phenomenon of interest to represent the remaining”, while according to Varkevisser et al. (1991) a multistage sampling “is carried out in phases and usually involves more than one sampling method”. The researcher uses judgement in selecting the sample (Grinnell Jr. 1993). Babbie comments “occasionally it may be appropriate for the researcher to select their sample on the basis of their own knowledge of the population, its elements, and the nature of research aims” (Babbie 1995). Moreover, Rossi and Freeman (1993) caution, “despite their obvious limitations, we do not mean to argue that judgmental assessment should never be used in assessing the impact of programmes.” Furthermore, “evaluators may need to resort to judgmental design when only very little funds are available; when no pre-intervention measure exist, so that reflexive controls can not be used; or when every one is covered by a programme and the programme is uniform over places and time, so that neither randomised nor constructed controls can be used” (Rossi & Freeman 1993).

The researcher used purposive sampling with full awareness of the biases that could be introduced by using the approach. However, compared with other disparities, which could affect the execution of the study, the minimal biases involved were considered reasonable. Moreover, as mentioned earlier, since Mbeya region was the location of pilot testing of the MIS before countrywide replication, its selection carries considerably more advantages than disadvantages. After selection of the region, multi-stage cluster sampling was used to select districts, primary health facilities and respondents as well as data collection tools included in the study. According to Varkevisser et al. (1991), multi-stage sampling is carried out in phases and usually involves more than one sampling method. Each stage of sampling is in itself a simple random sample or a systematic random sample, and the stages are combined to build on one another and arrive at a final sample (Grinnell Jr. 1993). While simple random or probability sampling involve random selection procedures, which ensures that each unit of the sample is chosen on the basis of chance, and that all units of the study population have an equal or at least known chance of being included in the sample (Varkevisser et al. 1991).

As mentioned above, Mbeya region has eight districts. Therefore in order to obtain the two districts a simple random-sampling procedure was performed. By this procedure Mbeya rural and Mbarali districts were selected and included in the study. Furthermore, from the two selected districts, four health centres and seven dispensaries to be used for collecting data for_this study were again cluster-sampled. This procedure fulfilled the whole process of multi-stage sampling. In order to fulfil the criterion of parameter of interest (involvement), both public and private health facilities had to be given equal chances. Further random-sampling was sequentially performed at the primary health facility, the district and the region in order to obtain four monthly reports from the annual report for the year 1998. The sampling procedure for obtaining the parameters of interest; region, districts, health facilities and data collection tools (tally sheets, forms, registers and report books) necessitated four steps as described below.

Step one - selection of region: The United Republic of Tanzania (Tanganyika and Zanzibar) comprises 26 regions (25 at the time of data collection). The mainland comprises 21 regions, while the remaining five regions form Zanzibar Island. Zanzibar does not use MTUHA as its routine health data reporting system. As stated above, purposive sampling was used to select Mbeya region from the twenty-one regions of mainland Tanzania (Tanganyika).

Step two - selection of districts: Simple random sampling was performed to obtain two districts from the selected region. According to Rossi and Freeman (1993), the terms random-sampling and randomisation ought to be distinguished, as they bear different meanings, despite the perceptions of many. Randomisation means taking a set of units and allocating each unit to an experimental or control group by means of randomising procedures. Random sampling, on the other hand, consists of selecting units in an unbiased manner to form a representative sample from a population. (For more on random sampling versus randomisation see Rossi and Freeman 1993, p. 267).

Administratively, Mbeya region is divided into eight districts: Mbeya urban, Mbeya rural, Mbarali, Rungwe, Kyela, Ileje, Chunya and Mbozi (Appendix i). The districts were numerically listed: small pieces of papers bearing numbers similar to those assigned to the districts were used in the random selection procedure. To carry out the procedure, one member of the Mbeya rural DHMT was assigned to pick up the pieces of papers bearing numbers, which were matched to a list of the districts. The method saw Mbeya rural and Mbarali districts being selected for inclusion in the study.

Step three - selection of health facility: Again, a simple random sampling procedure was used to select four health centres and seven dispensaries. The procedure was carried out after the completion of step two. All governmental and non-governmental health facilities in Mbeya rural and Mbarali districts were assigned numbers, which were then used to randomly select health facilities. Although the procedure was substantially the same, health centres and dispensaries were selected separately. According to the Mbeya Region Annual Health Report (2000), at the time this study was being conducted, Mbeya Region had 13 hospitals: 4 were run by the government (public), 4 by voluntary agencies and the remaining 5 by private corporations. There were 29 health centres: 17 belonged to the government, 8 belonged to voluntary agencies, three were privately owned by individuals and one belonged to a parastatal organisation. On the other hand, the number of dispensaries was 271, of which 185 were governmental, 41 run by voluntary agencies, 12 owned by parastatal organisations, and 33 privately-run.

More specifically, one selected district, the Mbeya rural, had four health centres, of which three were public and one private. The number of dispensaries was 34; 31 of them were public, two private, and one owned by a parastatal organisation. On the other hand, the other selected district, Mbarali district, had two health centres, one being publicly owned and the other private, and the number of dispensaries was 45, of which 43 were publicly owned and the remaining two belonged to religious organisations. Both districts had a single mission hospital; however, currently Mbarali has an additional public hospital (Rujewa health centre having been upgraded in 2002). Plans are also ongoing to upgrade Ujewa mission dispensary into a hospital. The structure shows a typical mix of private and public health facilities, a situation which is becoming ever more common, especially in urban settings.

Step four - selection of HMIS data collection tools: Another sampling procedure conducted was for data collection tools: tally sheets, forms, registers, and report books used by health facility workers for routine collection of health data. The procedure also involved report forms used by the District and Regional Health Management Teams (DHMT and RHMT), both for the year 1998, with the corresponding months being sampled for tools in the primary facilities. Based on the four quarters of the year, it was feasible to select one month from each quarter of the year: hence January, April, August and December were randomly selected by selecting one month per quarter. The reason for choosing 1998 was that in 1998 some minor changes on information requirements were introduced: forms and frequency for reporting were adapted from HMIS version 1.0 producing HMIS Version 2.0. Therefore it would have been useless to select years before implementation of HMIS version 2.0. Doing so could in any case have impinged on the study findings, and likewise the study recommendations. Hence the selection of the year 1998 enabled an assessment of the new changes. Moreover, taking into consideration poor report storage facilities, it would have been difficult to obtain complete reports for the years prior to 1998.

5.2.2 Non-random sampling used in obtaining respondents

Non-random convenient sampling, sometimes called availability sampling, is a procedure used extensively in social work research, which relies on the closest and most available subjects to constitute the sample (Grinnell Jr. 1993). Wright et al. (1998) argue that the choice of subjects for questionnaire or interviews will determine whether the results can be generalised. This sampling can be done randomly, systematically or by purposefully selecting key informants or people with expert knowledge such as health workers, government officials and so on. They caution, however, that care should be taken to select key informants that reflect the range of different interest groups. (Wright et al. 1998). These recommendations by Wright and others were observed during the selection of primary health care workers and officials at the Ministry of Health. Nevertheless I would like to observe that the use of non-random sampling might have introduced a minimal bias that might decrease the validity of the results of this study. However, the procedure was found more convenient to use across all levels owing to my concern to involve as many health workers as possible working in routine health data collection without any fixed minimum or maximum number. Therefore possible deficiencies in this study should be related, not to the number of respondents, but to the limited number of facilities included because of funding constraints and the time available for data collection.

The sample: Different cadres, or professional groups, of health workers exist at different levels as part of the health care system. All workers implement the information system among other duties. In this case, there was no need for criteria to select respondents to be included in the study across all levels. Consequently the presence or availability of a health worker in a particular health facility at the time when the study was being executed determined ones inclusion as a respondent. However, despite the respondent's inclusion by non-random (convenient) sampling in the individual interview, voluntary participation in the focus group discussion (FGD) was the norm. During the individual interviews, respondents were informed that there would be focus group discussion and asked if they would be willing to participate. Hence, willingness was the main criterion for inclusion in the FGD.

The study involved 87 respondents from primary, secondary and tertiary levels of health care delivery. A total of 60 respondents were recruited from the PHC, 15 from the two districts, 10 from the region and two from the Ministry of Health, in particular from the HMIS unit. Table 2 below shows respondents from the primary facility, RHMT and DHMT according to their professional background.

Table 2. Primary facility, RHMT and DHMT respondents by professional background

Respondent's title	Facility level				Total
	Primary		Secondary		
	Dispensary	Health centre	DHMT	RHMT	
Medical Officer	-	-	1	2	3
Pharmacist	-	-	-	1	1
Asst. Medical Officer	-	1	-	-	1
Health Officer	-	-	5	3	8
Clinical Officer	5	9	1	-	15
Asst. Clinical Officer	3	5	-	-	8
Nursing Officer	-	-	3	2	5
Public Health Nurse "A"	-	-	2	2	4
Public Health Nurse "B"	-	2	2	-	4
Health Assist.	-	-	1	-	1
Nurse-midwife	1	8	-	-	9
Maternal Child Health Aide	5	8	-	-	13
Laboratory Att.	1	4	-	-	5
Medical Att.	2	1	-	-	3
Medical Rec. Assist.	-	5	-	-	5
Total	**17**	**43**	**15**	**10**	**85**

Of the 60 primary health care workers interviewed, 38 (see table 3 below) took part in the subsequent focus group discussions. The FGDs were convened in five settings these are Madibira, Ujewa and Rujewa in Mbarali district and Inyala and Mbalizi in Mbeya rural district. Two sites pooled workers from more than one facility; the single members from Igawa and Nsonyanga dispensaries participated in the Rujewa and Inyala group respectively. Logistic issues such as lack of transport hindered two participants from Iwindi and Izubwe from participating in the Mbalizi focus group. A list of participants in the discussions by respondent's title and centre is shown in Table 3 below.

Table 3 Primary facility workers participating in FGD by title and group centre

Respondent's title	Name of health facility					Total
	Madibira health centre	Inyala health centre	Rujewa health centre	Ujewa health centre	Mbalizi dispensary	
AMO	-	1	-	-	-	1
CO	2	2	2	2	3	11
ACO	-	1*	1*	1	-	3
PHN	-	1	-	-	-	1
NMW	2	3	1	1	1	8
MCHA	1	1	3	1	-	6
Lab Att.	1	-	-	1	1	3
Med Rec. Asst.	1	1	1	1	1	5
Total	**7**	**10**	**8**	**7**	**6**	**38**

* Participating from satellite dispensaries

Key: AMO Assistant Medical Officer; CO Clinical Officer; ACO Assistant Clinical Officer; PHN Public Health Nurse; NMW Nurse-midwife; MCHA Maternal and Child Health Aide; Lab Att. Laboratory Attendant; and Med Rec Asst. Medical Recorder Assistant

Interviews at district and regional levels: Participants at the secondary levels were drawn from the District and Regional Health Management Teams. In addition to performing their normal administrative duties, the team members are also responsible for supervising primary health care workers as well as for collecting and compiling information from these levels. In principle every DHMT and RHMT member was supposed to participate in an interview. However, for various reasons, some RHMT members, such as the Medical Officer of Health and District TB and Leprosy for Mbarali district, the Regional Laboratory Officer, and the Regional Eye Specialist, were unable to participate.

A total of 15 DHMT members were interviewed, 10 of which came from Mbeya rural district and five from Mbarali district. The composition of DHMT members was as follows: Medical Officer (1), Clinical Officer (1), Public Health Nurses Grade A (2), Health Officers (5), Health Assistant (1), Public Health Nurse Grade B (1), and Nursing Officers (3). Participants for RHMT consisted of Medical Officers (2), Nursing Officers (2), and Health Officers (3), as well as Public Health Nurses

Grade A (2) and one Pharmacist. A summary of primary facility workers, DHMT and RHMT members can be seen in Table 1 above. It is worth noting, as mentioned elsewhere, that Mbarali district, which was established in 1995 by separation it from Mbeya rural district, does not have all the DHMT staff required to cover the different sections.

In-depth interviews with ministry of health officials: Only two Ministry of Health workers from the HMIS unit participated in the interviews (not included in Table 2 above). The reason for so few participants at the ministerial level was that the unit has only 8 permanent workers, and during the period of the study, most of the workers were away on regional supervision. This shortfall is one of the limitations of the procedure (convenient sampling) that was employed for obtaining the respondents. Thus across all levels the study included eighty-seven respondents in total. The multiple sampling procedures are well summarised as follows: in simple random-sampling, until the desired sample is obtained, the element of interest is selected one at a time (Babbie 1995 cf. Grinnell Jr. 1993).

5.2.3 Combined method (qualitative and quantitative) used for data collection

In order to gain an insight into the complexity of the HMIS issue and the various cadres involved in its operation, a combination of qualitative and quantitative research methods were employed, as is recommended when dealing with such complex issues. As such, the qualitative part included individual interviews (open-ended questions), focus group discussions and in-depth interviews with key respondents. In addition an observation checklist was used (see also Gilson et al. 1994) and photographs were taken at the primary and secondary levels. On the other hand, the quantitative part was based on closed questions, such as questions on age, sex, and level of education, and others that required a yes/no answer. A brief explanation of the two methods (qualitative and quantitative) is given in the following paragraphs. The distinction between the two methods including the strengths and weaknesses of each will be elaborated in the discussion in Chapter 7. However, some comments on combining qualitative and quantitative methods are put forward here in advance.

According to Creswell (1994), a combined method is one in which the researcher uses multiple methods of data collection and analysis. Ideally a combination of methods should be used when assessing health needs (Wright et al. 1998). In addition, these methods might be drawn from *within methods* (approaches), such as different types of quantitative data collection strategies (for example survey and experimental). Alternatively they might be *between methods* drawing from qualitative and quantitative procedures such as surveys and in-depth interview. The current study is based more on the latter, as can be seen below. Hence no single method exhausts the need for data collection, and combining qualitative and quantitative methods of data collection improves the quality of the data as well as the results.

The idea of combining qualitative and quantitative approaches in a single study owes much to past discussion about mixing methods, and combining research designs in all phases of a study (Creswell 1994). Creswell (1994) describes how, as long ago as 1959, Campbell and Fisk sought to use more than one method to measure a psychological trait in order to ensure that the variance was reflected in the trait and not in the method.

Qualitative method explained: According to Chadwick et al. (1984), interviews range along a continuum from highly structured interview schedules to largely unstructured and undirected exploratory interviews. Structured interview permit no deviation from the schedule, while unstructured interviews permit deviation from the schedule, and for example further probing. In designing the questionnaire for this study, the decision was taken to employ interviews from the more unstructured pole of the continuum. In other words, the interviews included specific questions, which were nevertheless posed in a largely open-ended format. In this kind of interview format, respondents are all asked the same questions, but are given freedom to answer them in the manner of their choice (Chadwick et al. 1984). The principal investigator, therefore, in order to enhance proper analysis, needed to categorise the responses according to content.

Qualitative data are obtained through qualitative research, which refers to several different modes of data collection, including field research, participatory observation, in-depth interviews, ethno-methodology, total participation and group interviews, to mention a few. There are substantial differences among these research strategies, but they all emphasise “getting close to the data” and are based on the concept that “experience” is the best way to understand social behaviour (Chadwick et al. 1984). Qualitative research uses an essentially unstructured approach to data collection. Qualitative methods are mostly used to help the contents of the questionnaire and design of the questions. Sometimes qualitative methods are used in a complementary role to quantitative research (Chadwick et al. 1984). For further details of these techniques, see (Chadwick et al. 1984, Grinnell Jr. 1993, Babbie 1995 and Creswell 1994).

Quantitative methods (interviews): In conclusion on the methods for data collection Grinnell states that "The researcher must know whether an obtrusive or non-obtrusive method should be used; whether a self-report questionnaire or face-to-face interview would provide better data; whether available data can be obtained with secondary or content analysis or new data need to be collected directly, and whether a structural observation method should be used or less rigid observation would suffice. Then the advantage and disadvantage of each specific method chosen to fit the researchers' requirements should be analysed to avoid the development of unrealistic expectations about what a particular method can do" (Grinnell Jr. 1993, p. 322).

5.3 Material

Chadwick et al. (1984) explain that the type of instrument chosen will be determined by the particular research need, and the purpose of the research. They comment, however, that for information collected by interview to produce reliable, scientifically valid and valuable data, the researcher must be equipped with knowledge. This knowledge should enable the researcher to detect errors such as those resulting from purposeful intent on the part of the respondent to deceive or mislead, or problems associated with the temporary role of the respondent (Chadwick et al. 1984). Other potential errors include those related to the psychological state of the respondent as well as involuntary errors. In order to avoid the latter, the research assistants need to undergo a comprehensive training (Chadwick et al. 1984).

The development of research tools depends on many issues, such as the design of the study, its objective and the type of respondents for whom the study questions are intended, as well as the method of data analysis unconstrained by financial and time resources. Similarly, according to Grinnell Jr. (1993) and others, the financial and physical resources needed, and the time needed to carry out the study, are factors that need to be considered in the selection of a data collection method. Furthermore selecting the appropriate data collection methods that might be used for a study requires knowledge of the research in question, the research design, and the functions served by various methods (Grinnell Jr. 1993).

In Tanzania, as in all other countries, health services are delivered at different hierarchical administrative levels. Correspondingly, the complex health system is made up of multi-purpose workers. These workers are essential actors in health care delivery as well as in the implementation of the MIS as a whole. This being the case, their involvement in the development of HMIS as well as in this study was a crucial issue, and consequently the design of this study needed to take this setting into account.

Three types of questionnaires: Considering the differences in levels of health care delivery and roles of health workers, as well as their roles in implementing the MIS, the development of a common questionnaire was considered difficult. Similarly, Turunen et al. (2000), in a study on one stakeholder group with a stake in the evaluation of medical information system, observed that when the MIS is used in different ways, the design of a common questionnaire is difficult because of the differences in background of the various people participating in the study. From this point of view, the designing of three distinct types of questionnaires was considered necessary: a uniform questionnaire for all primary facility workers (Appendix ii), a uniform questionnaire for District Health Management Team members (Appendix iii), and a uniform questionnaire for Regional Health Management Team members (Appendix iv). The questionnaire was developed from the experience of the principal investigator on the current information system, and also adopted questions that have already been used other researchers in other settings, for example, Campbell's (1997) study carried out in Ghana and Nepal. The use of such questions increases the validity and reliability of a study.

According to Chadwick et al. (1984) personal and group interactions are important in data collection. They suggest that such interactions are crucial in eliciting respondents' knowledge and attitude. In the light of this suggestion, the combined method of data collection (qualitative and quantitative) was deemed more significant for eliciting knowledge and attitudes of workers about their involvement during both the design and implementation of the MIS.

Following the individual interviews, in order to facilitate the procedure for focus group discussions and in-depth interviews, two separate question guides (one for FGDs and one for in-depth interviews) were developed, details of which are provided in the following section.

The FGD question guide: Since focus group discussion was one of the methods acknowledged for data collection in particular at the primary level, consideration for the design of a question guide (Appendix v) focused on what prevailed in the individual interviews at the PHC. The discussion was intended to supplement the information obtained by interviews, the development of the FGD question guide had to follow after the initial individual interviews. This course of action was expected to provide the opportunity for the incorporation of discussion on issues from individual interviews, which needed more clarification; in addition, the discussions were expected to prompt active discussion. In practice, the guide allowed the moderator to include probing questions on areas that had showed some weaknesses in the individual interview, hence meeting the objective of complementing the questionnaire. Similar approach has also been used in other studies such as one by Gilson et al. (1992), but the opposite approach can also found.

The question guide for the in-depth interview and checklist: In addition to the data collection tools explained above, questionnaires and the FGD question guide, another question guide was designed (Appendix vii) specifically for in-depth interviews with the workers at the MoH HMIS unit in particular. For similar reasons an observation checklist (Appendix vi) was also developed, the checklist was specifically used to assess the quality of data: completeness of data collection tools, correctness of data as well as cleanness of data collection tools.

5.4 Ethical considerations

"As we develop our data collection techniques, we need to consider whether our research procedures are likely to cause any physical or emotional harm" (Varkevisser et al. 1991). Furthermore, Babbie (1995) points out "ethical procedure involves accurately informing subjects or respondents about the nature of the research and obtaining their verbal or written consent on willingness to participate". Thus the data obtained will be more valid and reliable.

Permission to conduct this study was obtained from the Ministry of Health in Tanzania, from Regional and District offices, health facilities in the sampled areas and also from the district where pilot-testing was conducted. Similarly, individuals were informed about the study and willingly took part and gave responses.

This is consistent with general advice for research as well as advice given by the Ministry of Health in Tanzania. "HMIS data/health statistics are confidential and are not supposed to be given out without the permission of the ministry" (Ministry of Health 1998 and 1998c). Equally, in many countries research proposals have to be screened for scientific and ethical integrity by the National Research Council (Varkevisser et al. 1991). Consequently nowadays many organisations have formalised research procedures and even produced their own ethical guidelines and protocols (Bell 1999). As such, in order to obtain the permission for this study the principal investigator held meetings with responsible persons at the respective levels. Such meetings included one with the

Director for Human Resource Development and Training at the MoH, thereafter with the Regional Medical Officer and District Medical Officers in the respective region and districts. Briefing on the research ensured a high degree of co-operation at all levels. The Director for Human Resource Development and Training acting on behalf of the Permanent Secretary handed over an official letter of permission. The permission was shown to and accepted by the officer responsible at the next level below (RMO). The RMO confirmed that there was no necessity for any additional document, and so the same consent letter was shown to the DMOs and similarly to the officers in charge of each primary facility, who had previously been circulated with the data collection schedule. Juntunen (2001) in her study on professional and lay care in the Tanzanian village of Ilembula used a different approach. She states: "I first had the permission from the administrator of Ilembula Lutheran hospital, likewise from Ilembula village leaders and finally from the Ministry of Health at the health system research unit, this was only possible after introducing my research plan" (Juntunen, 2001). Despite this different approach on obtaining permission, which basically varied according to the type of study or administrative setting, it is important to undergo the process for integrity and safety of one's research. Anonymity were assured to participants at all levels and maintained.

5.5 Pilot-testing of research tools

The principal investigator carried out pilot-testing of the tools for this particular study. The data collection instruments were pilot-tested in Mbeya urban district at Kiwanja Mpaka health centre and Mwansekwa dispensary. These two health facilities are situated away from the study area (see Appendix i, map of Tanzania showing Mbeya Region). Pilot-testing of the instruments outside the districts under study was important in order to avoid contamination of the study. After the pilot-testing, a deeper understanding of the instruments was achieved, and more light was shed on issues to be corrected and emphasised during research assistant training as well as throughout the execution of the study. Ten health workers were involved in the pilot-testing: two clinical officers, two nurse-midwives, a public health nurse, an assistant clinical officer, two maternal child health aides, a laboratory assistant, and a medical recorder. The institutional settings and workers participating in the pilot-testing corresponded to a great extent to those anticipated for the actual study. In addition, the pilot-testing acted as a control measure of the validity and reliability of the instruments.

According to Varkevisser et al. (1991), the terms pilot-test and pilot study are frequently either confused or used inter-changeably. A distinction must be made between pilot-test and pilot-study. "Pilot-study is the process of carrying out a preliminary study, going through the entire research procedure with a small sample. On the other hand, pre-test usually refers to a small-scale trial of a particular research component." (Varkevisser et al. 1991). Babbie cautions: "no matter how carefully you design a data collection instrument, such as a questionnaire, there is always the possibility – indeed the certainty – of error. You are certain to make some mistakes: an ambiguous question, one that people are not capable of answering, or some other violation of the rule for constructing a questionnaire. The surest protection against such an error is to pre-test a questionnaire in full and/or in part" (Babbie 1995). Another scholar recommends that a measuring instrument (for example a data collection tool) should be evaluated before it is administered (Grinnell Jr. 1993). Furthermore, the instrument should also be pre-tested to determine whether the individuals responding to the questions understand them and have a favourable impression of the appearance and the utility of the instrument. Babbie (1995) describes additional pre-testing strategies as set out by Presser and Blair.

5.6 Selection and training of the research assistant

In this study, the research assistant, who as an assistant medical officer (AMO) was drawn from the medical profession, was a final year medical student who had a knowledge of the health management information system as well as of the local geographical area where the study was to be conducted. Varkevisser et al. (1991) advise that research assistants should be selected with care. The assistant should preferably come from the field of study concerned, and be knowledgeable both of the topic under study and of the local environment. The fact that the topic was complex necessitated the selection of a research assistant knowledgeable about the topic. A similar approach is reported by Gilson, who argued that "the field workers were all experienced community workers, accustomed to liaising with the community" (Gilson, et al. 1994).

In reality, the use of knowledgeable/experienced research assistants enables investigators to identify exaggeration or misrepresentation and apparent inconsistencies in the information given by the respondents. One advantage with a knowledgeable assistant is that there is the possibility of an on-the-spot inquiry for clarification of ambiguous responses. Initially it was anticipated that four research assistants would be employed; however, because of financial constraints only one research assistant could be recruited and trained. The assistant was trained in how best to administer the questionnaire and complete the checklist as well as in taking notes during focus group discussions. This training took one day. In the light of the shortfall in the number of research assistants, extra hours had to be worked so as to keep up with the time schedule.

Although it is customary to experience some interruptions during data collection, no serious interruptions in the plan were encountered during the data collection for this study. Sometimes respondents might have other important tasks at the time when they are needed to respond to the questionnaire. Such interruptions can be special campaigns (e.g. national immunisation days), attending seminars or workshops or outbreaks of diseases such as cholera or meningitis that are not uncommon.

5.7 Bias elimination

A single researcher is sometimes involved in the selection of the area, materials to be used and analysing the data and preparing the findings to be presented in the final report. This illustrates the fact that there is a possibility of distortion of information, which sometimes makes generalisability impossible, as Bell (1999) points out. Other aspects that were also given due consideration during data collection were other sources of bias, mainly those appearing during interviews. According to Chadwick and others, these include the personal characteristics of the interviewer, the effective performance of the interviewing role and personal attitudes (Chadwick et al. 1984, Babbie 1995). Although it is difficult to eliminate all sources of interview bias, the principle investigator attempted to reduce the probability of serious bias by carefully selecting the topics to be covered in the interviews.

Other measures taken to eliminate bias included training of the research assistant on proper interviewing and note taking, and framing and asking interview questions carefully to avoid ambiguous questions and answers. As for the questionnaires, the wording and ordering (sequencing) of questions in the interview schedule were given due consideration. Furthermore, in order to ensure correct chronology and the quality of responses, the research assistant was required to ask the right questions in the right way. The principal investigator was also indebted to these principles. Together with the measures outlined above, the principal investigator provided the necessary supportive supervision to the research assistant throughout data collection. Moreover, completed questionnaires were revised after every day's work. Once again this enabled detection of certain discrepancies, which were discussed together with the assistant and promptly acted on. Code numbers given to each of the interviewers enhanced follow-up of other logistic issues in specific questionnaires.

5.8 The process for data collection

The process for data collection commenced in mid-May 2000 and was completed by the last week of September 2000. The process involved obtaining permission to conduct the study, piloting research tools and development of the final tools. The principal investigator together with the trained research assistant collected the data on every working day (Monday to Friday). The process started at the primary level of health care delivery (dispensary and health centre) followed by the secondary level (offices of the District and Regional Medical Officers) and finally at the tertiary level (Ministry of Health, in particular at the HMIS unit). It was necessary to follow this pattern so as to facilitate systematic follow-up of information in accordance with the national health information flow (Julkunen 1995, Health Research for Action 2000, Kalowela 2001). Similarly, the formality was important so as to avoid contamination of the study by staff from levels above during HIS supervision and routine schedules to lower levels or in any other way. As stated elsewhere, individual interviews and observation of the quality of data and data collection tools at primary level preceded the focused group discussions (FGDs). The following explains further how these tools were administered.

5.8.1 Individual interviews

As stated elsewhere, this study used individual interviews administered by questionnaire. These interviews were conducted with facility workers, DHMT and RHMT members. On an individual basis, interviewees were asked questions and the principle investigator or the research assistant recorded the answers. At the level of the Ministry of Health, the principle investigator carried out two in-depth interviews, and obtained copies of the annual health abstract and other valuable documents related to the HMIS protocol for further scrutiny. It was important to limit the method for data collection at secondary and tertiary level to individual and in-depth interviews respectively. At these levels, the use of FGD would have given little possibility of obtaining valuable information. It was perceived that in groups these participants would prefer to reserve their comments, which, could however be expressed when they were encountered on an individual basis.

Chadwick et al. (1984) highlights that interviews provide the opportunity for the researcher to probe deeply, uncover new clues, open new dimensions of a problem and secure vivid, accurate, inclusive accounts that are based on personal experience. Again, since data collection at this level was only carried out after data collection at the lower health facilities, there was room for the principal investigator to structure a few questions on issues, which arose at the lower levels.

5.8.2 Focus group discussions

The principal investigator moderated the focus group discussions, while the research assistant used during the interviews, who was also familiar with conducting FGDs, assisted with note taking. Tape-recording was only possible after consent had been obtained from the respondents. Recording was aimed at assisting the analysis by re-playing and making notes (transcription) from the recorded discussion proceedings. Other researchers report similar techniques "each discussion was guided by one person, with the second taking notes: tape recorders were also used to record discussions" (Gilson et al. 1994). Owing to constraints of funds, time and transport logistics, which hindered the possibility to bring together the respondents from the scattered health facilities to a meeting point a total of five focus group discussions (FGDs) instead of the six as originally planned, managed.

According to Chadwick et al. (1984), after analysis of pilot-test interviews and following actual responses from the study, the researcher comes up with issues to be included in the focus group discussion. A similar method was used in Bailit's study (Bailit 2002). However, the reverse order of group discussion followed by interviews is also found. It was therefore necessary to use primary health facility workers, and specifically those who participated in the initial interview (this was not a condition, but a more cost-effective approach). The number of participants in each group ranged between 6 and 10, and participation was voluntary. In other words, respondents after the interview were asked if they would be willing to participate in the scheduled FGD, and only those who were willing were then recruited. Available literature from different authors shows different opinions on the ideal number of people in a single group discussion. Typically, 12-15 people are brought together in a room to engage in a guided discussion (Babbie 1995). Babbie further comments that one single group of 7 to 12 participants would be too atypical to offer any generalisable insights. In other words, for the sake of generalisability, more than one group, each with no less than 7 participants is more acceptable.

Despite variations in the number of participants enrolled in each group, the number (6-10) in this particular study was within the limits suggested by different authors. The number of PHC workers who volunteers to participate in the group discussions determined the number of participants. This is in conformity with what has earlier been carried out by Gilson "...focus group discussion with a group of 6-12 people, were held" (Gilson et al. 1994). In other studies FGDs have involved even fewer participants with even fewer numbers of sessions, for example Eysenbach and Köhler (2002) in their study report "we held three group sessions with 6-8 participants each, we selected them on a first come first served basis". Further, each session was facilitated by a skilled moderator and lasted about two to three hours (which in my opinion was perhaps too long). In addition they audio taped, videotaped, and transcribed the group discussion.

Focus Group Discussion process explained: As stated elsewhere the overall study encompasses the use of combined methods for data collection. A total of 5 group discussions were convened, involving altogether 38 primary facility workers. All discussions were conducted at health centres, and so participants from dispensaries had to travel to where the FGDs were organised.

During each focus group discussion, the variety of topics reviewed consisted of four broad areas which needed further elaboration, either because these areas were not included in the individual interviews or because they showed up weaknesses in the system which emerged from the interviews. The topics that were outlined for the group discussions were as follows:

- Participation or involvement in MTUHA during the period from initialisation to implementation (data collection as well as data reporting)
- Training for MTUHA among primary facility workers
- Supervision (community visits by primary facility workers, DHMT supervision to facility), and
- HMIS indicators

Other issues, which emerged during the discussion, were:

- Allowances and other incentives
- Quality and reliability of data
- Further training and continuing education

FGD Climate-setting: The following section elaborates how the group discussions were organised and conducted. The Principal Investigator initiated the process for the FGD as follows:

> This is a study team trying to look on a number of issues related to MTUHA. The aim of this discussion is to collect additional information from what you have already responded to in the individual interview. We are not here to criticise the system, but rather to discuss and seek ideas on how MTUHA could be improved. Your positive contributions are therefore very crucial for future improvement of the information system. Since this is a group discussion, we would therefore appreciate if every one of you feel-free enough to offer suggestions. We consider that there is no wrong answer but some need further discussion or improvement. Also, it will be more useful if the discussions are as frank and honest as possible.
>
> We shall after my brief explanation choose a chairperson who will invite us to contribute to the proceeding discussion. Our discussion will range between one hour to an hour and half. In that case we shall choose a one person to keep time - having no watch should not prevent a person from being selected, as someone could borrow my watch for this particular activity [laughter from all participants]. It is the contention of the researchers that the proceedings of this discussion will remain confidential and be used only for the primary purpose of this study. Our colleague here [name not mentioned as self introduction was to take place shortly] will be taking notes on what we should be discussing. Therefore, I would like to ask permission to allow note taking. Likewise I would like to ask your permission to tape-record our proceeding [It seems you miss us, you want to take our voice with you to Europe - Joke from one participant! The PI used to be in charge of this particular health facility at Inyala].

After this personal introduction a chairperson and a timekeeper were democratically chosen. The same process was used in all FGD centres. The next step was to introduce the purpose of HMIS. The introduced for the group discussion was as follows:

> I think we all know the purpose for HMIS. However, in brief, HMIS was introduced to collect essential routine health data to be used at all levels for making sound decisions. The decisions are intended to improve the quality of services delivered, ultimately improving the health status of Tanzanians.

Answers provided by participants in the FGD ranged from individual to collective, which means that some answers were confirmed by others, either from the same or another professional group. In some cases answers were refuted in a similar way. The corresponding discussions will be included in the main findings as referred to below. After this brief explanation of the principles of the focus group discussions, the discussion of the findings of this study will now move on to the checklist: another tool used to collect data.

5.8.3 Observational checklist

As mentioned elsewhere, the checklist in Appendix vi was used to assess the quality of data obtained, for cleanness, correctness and completeness of tally sheets, forms and registers used to collect data at different levels of health care delivery for the four selected months for year 1998 was assessed. Basically the checklist was designed according to the information system demands for information quality. Assessment of received reports from the lower level was also taken care at the district and regional levels.

5.9 Data analysis and presentation

The process for data analysis incorporated sorting, cleaning and numbering of questionnaires, which were done after every day's work (in the field). Basically data sorting and cleaning was the responsibility of the principle investigator. However, owing to the research assistant's experience, he revised his own questionnaires for completeness and correctness. Data for this study was entered and analysed by the use of the Scientific Programme for Social Science (SPSS version 11 and 11.5). The principal investigator carried out all data entry and transcription of FGD reports from the recorded cassettes and from the notes taken during the FGD according to themes at the University of Kuopio in Finland. The results obtained from this study are presented in the forms of tables, figures matrices for the FGD responses and statements cited in the text. Statistical tests include Chi Square and percentages are provided appropriately.

5.10 Dissemination of the research report

The principal investigator will use the study information to defend his Ph.D at the University of Kuopio. Further dissemination will be carried out to the MoH in Tanzania and other stakeholders such as fund providers for the HMIS and to other stakeholders and providers of funding for the HMIS, as well as to those actually involved in the study (health facility workers. Finally, the information will be presented in the form of articles to scientific journals so as to enable peers to access and comment on them.

6. RESULTS

This chapter presents the results of an evaluative study of the Health Management Information System in Tanzania. The results have emerged from a combination of the qualitative and quantitative methods used to collect data for this study. They are also a synthesis of secondary data (literature) and empirical data including interviews, group discussions and observations. Subsequently, the results are presented in order according to the objectives of the study (Chapter 5).

This chapter also provides a follow-up of the design and development of the Health Management Information System within the health care system in Tanzania (a system within a system). In addition, the results are based on the type of data collected and the tools used to collect the data at the primary level of health care delivery. Further, a demonstration of hierarchical information transmission including its feedback mechanism is given. Simultaneously, the quantity and quality of data collected, the facility workers' attitude towards the Health Management Information System (HMIS) and the incentives for motivation are explained. Finally, the results demonstrate how data are being handled and utilised at different hierarchical levels of the health care delivery system.

A total of 87 individuals took part in this study. Of this total, 60 were primary health care facility workers, 15 DHMT members, 10 RHMT members, and 2 officials from the Ministry of Health, all of whom participated in individual interviews. Of the 60 PHC workers who took part in individual interviews, 38 volunteered to participate in the focus group discussions.

6.1 Design and development of health management information systems

The findings of this study on how the Health Management Information System in Tanzania was designed are consistent with those reported from several other studies conducted elsewhere. MTUHA was designed in relation to the existing health care system in Tanzania, (Health Research for Action 2000). The in-depth interviews at the MoH reveal that the development of the system involved information system consultants (DANIDA) and also a variety of actors at the MoH, regional and district levels, as well as primary health facility workers. At the MoH level, different working committees were formed to analyse and discuss the need for integrating the existing information systems (Health Research for Action 2000). The MoH working committee was set up to formulate indicators and set targets for each indicator, to set criteria for catchment areas and target population allocation, and to develop tools for data collection: client cards, tally sheets, forms and registers. An additional task assigned to the committee was to design information flow patterns which would include feedback mechanisms, training strategies, and supervision and evaluation mechanisms. The process involved working with other stakeholders at different levels (regional and district), or in other words, establishing the elements of a participatory approach in designing the HMIS.

6.1.1 Participatory approach in designing information systems

The findings of this study conform to the explanation presented by the Ministry of Health (Ministry of Health 1993a). The approach employed was similar to that reported by Campbell to have been used in Ghana and Nepal: "... once the objectives for a HMIS were clarified and the situation analysis was completed, efforts began to focus on the participatory design: the integrated HMIS, prototype instruments and training materials" (Campbell 1997). The approach of participatory design is well established as a form of community participation, and the involvement of communities in planning, managing, monitoring and evaluation of health services is crucial to PHC (Braa 1995). Thus in exploring community-based participatory design, lessons from the early Scandinavian projects may be useful (Braa 1996). As such, participatory design of information systems is often seen as rooted in the Scandinavian tradition of co-operative programme design (Korpela 1998). A similar assertion comes from Ijadunola, who argued that community participation is a core philosophy of PHC (Ijadunola et al. 1998).

6.1.2 Health management information system policy

The in-depth interviews with the MoH officials revealed the non-existence of any HMIS policy. Subsequently no document mentioning policy on HMIS was found during the literature search. Health Research for Action states that at present there is no information policy or strategy at the MoH, nor there is any standard procedure for sharing information between departments within the MoH or between MoH and other ministries or partners in health (Health Research for Action 2000).

However, irrespective of the non-existence of an independent policy on HMIS, the clarification given during the interviews was that the broad national health policy (NHP) of 1990 had mandated HMIS to conceptualise and put in place a system for routine data collection. From this major overall policy, policy guidelines for HMIS were supposed to emerge. Despite this explanation, considerable concern was expressed during the analysis of the strengths and weaknesses of the

Ministry's health policy. Nevertheless, in the proposal for health sector reform (HSR) it is stated: "...among other issues, the national health policy (NHP) realizes the absence and development of tools for implementation of 'district health-planning guidelines and HMIS and their policies" (Ministry of Health 1994). Amazingly, despite the consensus about the absence of HMIS policy and the mandate given by the NHP, the respondents at the Ministry differed in opinion over the importance of information policy in the future, one being in favour and the other opposed.

The findings on policy conform to what had been observed by the Department of Health Services Delivery (DHSD) of the WHO: "Among key issues affecting national health information systems are policy on MIS, management and use of information systems." The department therefore emphasised the need for a clear official policy statement on HMIS as a demonstration of high-level policy commitment to building health systems (World Health Organisation 2000). Lack of information policy is one major issue identified which affects the performance of national health information systems.

6.1.3 Establishing indicators, catchments areas and target populations

Among important issues that were considered before development of the information system was the setting of goals for each program, which in turn gave the opportunity to develop targets for the goals. After the targets were set, measurements for their attainment (indicators) were developed. Campbell (1997) reports that in Ghana, during the development of tools, the first step was to clarify or develop goals, targets and indicators for each programme, and this was facilitated by the Management Information Systems Working Group (MISWG). Existing programmes in the health care system in Tanzania had existing goals, targets and indicators, which were not well defined. Although they were not well established, the programme goals and indicators facilitated the task of setting goals and developing indicators for the current MIS.

These findings conform with advice from Kurpa on Occupational Health and Safety (OH & S) indicators: "whenever possible it is wise to consolidate and build on information systems that are already in place rather than setting up new ones. However, if such systems are not in place, it is essential to establish a surveillance system with indicators that provide a means for monitoring OH & S situations" (Kurpa 2001). Rantanen and associates give additional advice concerning indicator quality: they should be reliable, valid, sensitive, feasible and comparable, and setting indicators based on these criteria improves the attainment of set goals at different levels (Rantanen et al.

2000). Pilot-testing of the IS in Mbeya rural district before implementation served to validate the feasibility of the indicators.

Development of indicators: In the Tanzanian context, according to the literature the process for indicator development was only possible after a definition of the same was made. According to the Ministry of Health, "an indicator is a fraction, which has a denominator and a numerator presented in percentage" (Ministry of Health 1993a, 1998b). An indicator has an upper limit (target) and an acceptable lower limit (threshold) set by the Ministry. Appropriate action has to be taken when an indicator is not attained (Ministry of Health 1993a, 1998b). Basically, the definition of an indicator differs considerably according to what the indicator is supposed to measure. For example, Heywood et al. (1994) defined indicator as a "variable, which helps to measure changes, and is used to describe the situation and measure changes over a period of time." Others define indicator differently.

According to Health Research for Action, in setting HMIS indicators, the Tanzanian working group further described an indicator as a direct or indirect measure of events such as health, service performance or resource availability (Health Research for Action, 2000). From this awareness of the essence of indicators in determining the performance of services in the health care system nation-wide, the working group based its development of HMIS indicators on the following characteristics:

- answers essential implementation questions related to equipments, activities, and short- and long-term outcomes,
- is a fraction, which has a denominator and numerator, which are derived from collected data and presented in rates per unit, average at a point in time and proportions at a point in time etc.
- has an upper limit known as *target* set by the Ministry
- has a lower acceptable limit known as *threshold*, with performance below the threshold signalling existence of a problem calling for immediate solution
- a statistical datum signalling the presence of a problem, however without clearly giving details of the problem, which leads to the need to find reasons for the existence of the problem
- is derived from data collected and periodically reported, depending on how frequently the data are needed or action is required (special questions exist for indicators generated)

Furthermore, the working group considered that districts are the main interface between the national level planning/management and a concrete knowledge of service provision at health facilities and in communities (Health Research for Action 2000). Districts are also considered to represent the lowest level where detailed knowledge of local needs and services meets with the necessary capacity to analyse and use data, including use of computer and information technology (informatics). In supporting the above argument, the Ministry of Health considers that "HMIS indicators are supposed to answer questions related to running of facilities in relation to equipments, services, as well as short and long-term outcomes" (Ministry of Health 1994).

Kurpa (2001) summarises criteria for selecting indicators as follows:
scientifically robust (i.e. valid, specific, sensitive and reliable)

- useful
- representative
- understandable
- accessible, and
- ethical

Heywood et al. (1994) give similar criteria for indicator quality, and add the importance for quality of the objectivity of an indicator. Nevertheless, they caution that not all indicators are likely to fulfil all these requirements, but emphasises that strong indicators are those that fulfil most characteristics. Thus deciding the correct indicator is difficult and needs the consensus of many users (Heywood et al. 1994). In conformity with this, Campbell et al. (1994) add that since HMIS indicators are designed to monitor progress towards achievement of specified goals and targets, identification of the most appropriate indicators is crucial. They cite an example of HMIS development in Ghana, where "extensive discussion surrounded the identification of the most appropriate indicators to monitor the coverage, and continuity of comprehensive Primary Care Health Services" (Campbell et al. 1994). Additionally, the World Health Organisation's Department of Health System Delivery (HSD), during the development of the HMIS in Mozambique, in what is termed as phase I, covered identification of critical issues to be addressed during the assessment, constructing an issue-indicator-data matrix and preparing data collection tools to be used during phase II (World Health Organisation 2000).

It was also found in this study that MTUHA has 10 indicators that are reported in the primary health facility quarterly report in form (F004). Other indicators are reported annually on the primary health facility annual report in form (F005). There are also additional indicators that are not reported to higher levels, but are to be used at the health facility level. Some MTUHA indicators are reported annually but are calculated and monitored at the health facility level quarterly (Ministry of Health 1998b). Most health indicators are expressed in terms of absolute numbers, rates, proportions and averages or categorical variables (present or absent). Further elaboration is beyond the scope of this work, but it is important to mention that calculations from the data collected are made to determine whether the indicated target has been reached or not. As stated elsewhere, if the answer is below the target threshold then there is a problem which calls for immediate action. Panel 3 below illustrates the calculation of an indicator.

Panel 3. How to calculate an indicator

Indicator = Numerator x 100/Denominator = ... %

It has already been pointed out that indicators are required to answer questions related to running of facilities and provide possibilities for comparability. Heywood et al. (1994) call indicators "yardsticks", whereby institutions or teams can compare themselves to others, and markers of progress towards defined specific objective.

According to the Ministry of Health, MTUHA assigns facility workers to calculate all indicators and report them according to their specified requirement as stated in the facility book. The facility book, available in all facilities, is equipped with some advice. For example, if targets are not reached, it is recommended to re-check both the calculations and the target population estimates with the DHMT (Ministry of Health 1998c). Other advice is to investigate the information available in the MTUHA In-charge (head of facility) booklet so as to determine why there is a problem, and then decide upon the best action to take. For example, if there were problems with vaccine supply or storage, equipment sterilisation or personnel, facility workers should think about strategies to improve the situation, or inspect the child register to see if some villages are more problematic than others. Additional questions, speculations and suggestions are provided in Panel 4 below.

Panel 4. Indicator questions, selected speculation and suggestions

Example 1: Q: Is the attendance at the antenatal clinic too low? The target and threshold are 100%. Speculations and optional solutions suggested are e.g. if all children are not registered, this could be because some children in the catchment population (service communities) use other health facilities. If this is the case, then your target population should be re-estimated together with the DHMT. But first ensure during community outreach that all children are being immunised. Use the VHWs and the VHC to seek out parents and children that are being forgotten.

Example 2: Q: Is the attendance at the antenatal clinic too low? The indicator is calculated according to the instructions in given in the facility book. The target is 90% and the threshold is 80%. If the attendance is less than 80% then actions must be taken to improve attendance.

Example 3: Q Is the rate of syphilis among antenatal clients too high? The indicator value is calculated in facility book. The target should be to continually decrease the rate each year. If the indicator is above 10% the first year, then there are serious problems and preventive actions should be taken to prevent and curb the spread of the disease.

Example 4: Q: Is the BCG coverage of the children under one too low? The target is 90% and the threshold is 80%. Is the DPT3 coverage of the children under one too low? The target is 90% and the threshold is 75%. Is the Polio 3 coverage of the children under one too low? The target is 90% and the threshold is 75%. Is the Measles coverage of the children under one too low? The target is 90% and the threshold is 75%.

Before the introduction of MTUHA, there were few indicators and no questions to be answered; in other words, workers simply worked to meet the set goals without having a threshold target which could signal a problem. In my personal experience at that time, in most cases only the supervisors and perhaps a few workers involved in report writing had any knowledge about indicators or how to calculate them. In addition, little or no feedback was given to workers on the overall facility performance. However, unlike the old vertical system, MTUHA allows workers to assess themselves through indicators.

One question which arises is whether it is realistic to set indicators for the management information system. The findings of the group discussions reveal that regardless of well-formulated MTUHA indicators, and most of them being reported as required, no solutions are given by DHMTs on persistent problematic indicators. This is what surprises facility workers. All facilities involved in this study, with the single exception of Mbalizi mission hospital, reported experiencing problems in attaining the set indicator targets. Inability to attain set targets has been reported to de-motivate facility workers, thereby creating a sense that MTUHA is not an action-led system as intended. The findings correspond to the explanatory comments of Heywood et al. (1994): "no task-force will ever get all indicators right first time, but do not be discouraged for that is why the HMIS needs to be flexible. Whatever happens, resist the temptation to expand the number of indicators; otherwise they will not be used, but look for better indicators not more".

Allocation of catchment areas: According to the guidebook to HMIS Version 2.0 (Ministry of Health 1998b), the geographical area where the majority of patients and clients reside is defined as the catchment area of the assigned health facility. As mentioned above, the target population is a crucial parameter for calculating indicators; the target population is the population located in a specified geographical area assigned to a facility. Target groups such as children under one year or under five years are embedded in a catchment area. Other target groups include women of child-bearing age and disabled persons. During the initiation of MTUHA, catchment areas were assigned to each health facility (Ministry of Health 1993a). In order to facilitate the allocation, the district compiled a list of all the assigned health facilities in the district to determine the catchment area of each assigned health facility (Ministry of Health 1993a, confirmed by personal experience). Heywood et al. (1994) suggest that catchment boundaries for districts and sub-districts must be defined in cooperation with all relevant district authorities. During the introduction of MTUHA, the catchment areas were established using population estimates based on the last census. The DHMT projected the catchments area and the catchment population for each assigned health facility for the current calendar year, and this was compared with that obtained from the health facility registers for compatibility (Ministry of Health 1993a, confirmed by personal experience).

The process of catchment population estimation involved counting the number of patients from outpatient department records and child registration as well as by community residence for a period of time (usually three months) (Ministry of Health 1993a). This exercise gave each assigned health facility a picture of where their patients/clients resided. It was expected that the number of people in the catchment area (catchment population), divided into target populations for different programme activities, would increase annually by the expected population growth rate (as illustrated in Panel 5 below). All calculations were carried out on the basis of a national population increase of 2.8% per annum. Health facility workers are taught how to update the total using their calculation of the annual increase, although the District Health Management Team crosschecks the figures at the beginning of each calendar year (Ministry of Health 1993a, Health Research for Action 2000).

Panel 5. Projecting catchment area population

A catchment area with 50,000 people in the year 1988 census and a 2.8% growth rate per annum would have a population increase of:
50,000 x 0.028 (2.8 % growth) x 13 yrs (2001-1988) = 18,200 more people.
Therefore, the population for 2001 is 50,000 + 18,200 = 68,200 people.

The findings in this study agree with those reported from a study in Ghana and Nepal. "In Ghana following the training of facility workers on the HMIS, which focused on the attention on identification of catchment and target populations, all sub-district health facilities in the three regions where HMIS was implemented, had their catchment populations clearly broken down into target populations for calculating indicators" (Campbell 1997).

Target populations: Different programmes have different target populations; for example, maternal and child health programmes aim to cover women of child-bearing age between 18 and 49 or 20% of the total catchment population (Bureau of Statistics [Tanzania] & Macro International Inc. 1997). Other target populations are children under 1 year or 5 years of age, respectively 4% and 20% of the total population of a catchment area. The outpatient department aims to cover all the people (100 %) in a catchment area. Similar proportions are used country-wide to calculate target populations for different programmes, and this allows comparability of performance. In other words, in order to determine the service coverage, the target denominator population has to be divided by the numerator (see Panels 3 and 5 above).

6.1.4 Development of data collection tools

In developing tools for an information system, should we develop new data collection tools and abandon all the tools used in an existing information system? It is very unlikely that an information system could be developed without reference back to what existed previously, because too much adaptation is detrimental, while too little will not suffice; the goal is to strike a balance.

The analysis of literature collected reveals that a wide range of tally sheets, forms and registers exist for each programme carried out in a health facility, even though each programme had its own specific tools used to obtain specific information. In order to facilitate standard information collection across facilities, the committee at the MoH scrutinized tools in use in the existing information system so as to develop standard tools for collecting only the information necessary for management and action-led decision-making at different health delivery levels. Incorporated into one report were forms and report formats that were used in the previous fragmented information systems. The old information system involved multiple vertical reporting systems for various programmes: the essential drugs programme (EDP), the expanded programme on immunization (EPI), the TB/Leprosy programme, family planning (FP), maternal and child health services (MCH), laboratory services, and in-patient and out-patient reports, to name but a few. The tools for collecting such information from such programmes were not standardised, limiting comparability of data between facilities, districts and even regions. Similarly, reports were also produced for each independent programme.

MTUHA Version 1.0 was introduced country-wide between 1994 and 1997, while MTUHA Version 2.0 began to be used in January 1998. Standardised tools have been put in place since Version 1.0, including a variety of client cards, tally sheets, forms, registers and report books. To convert Version 1.0 into 2.0, certain forms were modified and a few new registers were introduced into the new version. According to Health Research for Action (2000), "it was realised that monthly reporting was an unrealistic target taking into consideration the present problematic communication situation in Tanzania." As a result it was decided to revert to quarterly reporting at all levels. However, health facilities were still instructed to calculate monthly figures locally. Compared to MTUHA Version 1.0, which had ten booklets, Version 2.0 comprises twelve booklets, which are to be completed at the primary health facility level. The list of MTUHA version 2.0 booklets is summarised in Panel 6 below.

Panel 6. List of MTUHA booklets

No	**Type of booklet**	**Specifications**
1	Guidelines	Instructions on how to implement MTUHA
2	Health facility data book	Administrative issues; staff, buildings, finance, stores issues, also contains tables for the recording of information on clients who attend MCH Services.
3	Community book	Outreach, village health workers and TBA reports, Village health committee meetings etc.
4	Ledger book (mainly for drugs)	Type of drugs received, stock available at the beginning and end of the month
5	OPD register	Registration of outpatients, diagnosis, treatment, referrals and admissions etc.
6	ANC register	Attendances of pregnant women, TT vaccination recorded per village
7	Under five years child register	Child Growth Monitoring, weight, vaccination status etc.
8	Family planning	Methods of family planning
9	Diarrhoea treatment for < 5 years	Diarrhoea cases and treatment
10	Reports (to be submitted to higher levels)	Instructions on which reports and when to be submitted to higher levels
11	Dental register*	All issues related to dental services
12	Delivery register*	Women delivering in a facility and their complications, records of babies born

*Additional books in MTUHA Version 2.0

In addition to the information in the panel above, other tools for data collection are shown below in Illustrations 1a to 9b and in Appendix viii.

Maternal and Child Health (MCH) Service: Each major programme within the MCH has its own client cards that are used to monitor and manage the client. The cards are:

1. THE CHILD HEALTH CARD. This is given to children on their first contact with the health services and used until the child's fifth birthday. It is used for growth monitoring, child immunizations and morbidity. The parents keep the card.
2. THE ANTENATAL CARD. This is given to pregnant women on their first visit to the antenatal clinic. It is used to monitor each woman through her pregnancy, and is kept by the woman.

3. THE TETANUS CARD. This is given to all women on reaching child-bearing age or on their first pregnancy. It is a record of the woman's tetanus injections. The woman keeps the card.
4. THE FAMILY PLANNING CARD. This is the only card currently kept at the clinic. This contains a record of all family planning consultations held with the client.

There are five registers and two tally forms. The Health Facility Data Book contains tables for the recording of information on the clients who attend MCH Services. It is important routinely to monitor the use of these client cards, registers and tally forms in the MCH clinics. This is a role assigned to the DHMT.

Illustration 1a. Immunisations and Vitamins: a Tally Form (F202)

Hospital ------------ Code -------- Date form started ------------ Date form finished ---------

CHILD IMMUNISATIONS (tally by age group)				
	Under 1 year (<1 yr)	Sum	1+ years	Sum
BCG	00000 00000 00000 00000		00000 00000	
Polio 0	00000 00000 00000 00000		00000 00000	
Polio 1	00000 00000 00000 00000		00000 00000	
Polio 2	00000 00000 00000 00000		00000 00000	
Polio 3	00000 00000 00000 00000		00000 00000	
DPT 1	00000 00000 00000 00000		00000 00000	
DPT 2	00000 00000 00000 00000		00000 00000	
DPT 3	00000 00000 00000 0000		00000 00000	
Measles	00000 00000 00000 00000		00000 00000	

Key: DPT= Diphtheria Pertussis and Tetanus vaccine

Illustration 1b. Vitamin A Supplements tallies (capsules given to children when they experience diarrhoea or measles attack)

VITAMIN A SUPPLEMENTS		
Post Natal Mothers	00000 00000 00000 00000 00000 00000 00000	
Children at measles vaccination	00000 00000 00000 00000 00000 00000 00000	
Children at 15 months	00000 0000 00000 00000 00000 00000 00000 00000 00000 00000 00000 00000 00000 00000	
Children at 21 months	00000 00000 00000 00000 00000 00000 00000 00000 00000 00000 00000 00000 00000 00000	

Illustration 2. Antenatal Client's Tetanus Toxoid Immunisations tallies (tally by dose)

TT 1	TT 2	TT 3	TT 4	TT 5
00000 00000	00000	00000 00000	00000	00000
Non-pregnant women tetanus immunisations (tally by dose)				
TT 1	TT 2	TT 3	TT 4	TT 5
00000 00000	00000 00000	00000	00000	00000

Key: TT= Tetanus Toxoid vaccine

Illustration 3. Pregnant women attendances
Village.........

FIRST VISIT OF PREGNANCY											
Day/ Month	**Identify Number**		**Name**	**Brought TT card**	**Gestation age in Weeks**		**Maternal risks**				
					<20	**20 +**	**Gravidity**	**Age**	**Height**	**Ab**	**Cs**
1 Jan	9 3	0 0 1	Mary Nsuzu	Y				34	155	*0*	*0*
1 Jan	9 3	0 0 2	Merci Ndogo	N			1	18	150	*0*	*0*
(1)	(2)		(3)	(5)	(6)		(7)				

Key: Ab = abortion, Cs = Caesarean Section, Gravidity= number of pregnancies

The delivery register: The delivery register contains both mother and child information. It has been designed to be used both on maternity wards and in smaller health facility delivery rooms, and has been provided by MTUHA. One register has space for about 500 deliveries. In health facilities without in-patient services, all pregnancy outcomes are entered. This means that miscarriages, abortions, women delivering before arrival (BBA), live births and still births occurring at the health facility are also entered.

Illustration 4a. Delivery register

Delivery Date	Serial No	Name	Village	Age	Gravidity	Parity	Date of Admission	Outcome		
								BBA or Abortion	Type of delivery	Complications
28 Jun	234	Merci Ndogo	Uwanji	18	1	0	28 Jun	BBA	---	None
30 Jun	235	Joanna Thinga	Uwanji	38	8	7	29 June	--	Caesarean section	None
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)

Key: BBA=born before arrival in facility, Parity= number of deliveries that has already occurred

Illustration 4b: Delivery register facing page

Mother Final Status	Live Birth Information							Still Birth Information		Delivered by (Signature)
	Sex	Wgt kg	Apgar Score	Complications	Mothers Final Status					
					Well	D< 24 hrs	D24 hrs +	FSB	MSB	
Well	M	3.5	9	None				--	--	Joy K. Kitanda
Well	--	---	--	-----	--	--	--			Joy K. Kitanda
(12)	(13)							(14)		(15)

Key: D< 24 hrs= delivery in less than 24hrs after arrival at facility, D>24 delivery after 24 hrs… FSR= Fresh stillbirth: baby died during delivery process, MSB= Macerated baby: baby died some days before deliver, Apgar score= score given to the baby

Illustration 5. The Out-patient register

General section   Date page started...........

*	Attend. No.	Name	Village	Age	Sex	Diagnosis	Treatment
*	003	Yohanna Omari	Sambanga	52	F	Malaria - uncomplicated	CQ Tabs 4/4/2
	028	Yohanna Omari	Sambanga	52	M	Hypertension	Propranolol tabs 80mg BD x 7/7
*	101	Samantha Chitambi	Urembo	1/12	M	Otitis Media	Erythromycin syrup Q1D x 7/7
						Diarrhoea with dehydration	ORS
*		Kuyanga	Sambanga		M	Urinary Tract Infection	Cotrimoxazole tabs π BD x 7/7
	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Re-attendances							Referrals
00000 00000 00000 00000 00000							0,/0000 00000 00000 00000 00000 00000 0000

Illustration 6a. Staff listing form (F001)

Health facility --------------------------- Code ---------- Year ----------------
In-Charge ----------------- Name ---------------------- Title ---------------------- Signature----------------

File Number		Name of Employee	Name of Employer	Sex	Birth Year	Highest Level of Education	Professional Qualifications	Cadre and grade	Date first employment	Year of confirmation	Year of Last Promotion	Current Title
Employer	MoH											
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)

Illustration 6b. **(F001)** Facing page: List the short courses attended in the last five years by employee

Name of employee	**Short courses, informal training, and continuing education attended in the last five years**
(14)	(15)

The Laboratory: In order to have records of work done in the laboratory, a laboratory register is used. No pre-printed register is available through MTUHA; it is the responsibility of the health facility to provide a book that the laboratory staff can use. A description of the columns that should be included is shown below. More columns can be added if the health facility wishes.

Illustration 7. Recommended formats of columns for the laboratory register

Date	**Serial no.**	**Name**	**Age**	**Sex**	**Patient no.**		**Investigation**	**Test requested**	**Result**	**Abnormalities**	**Remarks**
					OPD	**IPD**					
(1)	(2)	(3)	(4)	(5)	(6)		(7)	(8)	(9)	(10)	(11)

Each line entry in the register is a specific test, so that if one patient has multiple tests then there would be multiple entries. In such cases, the patient's personal information (name, age, sex) need not be repeated.

Illustration 8a. Dental Register

Date	Attend No	Name	Village/ Address	Sex	Age	Diagnosis			
						Carries	Periodontal	Trauma	Neoplasm
(1)	(2)	(3)	(4)	(5)	(6)	(7)			

Illustration 8b. Dental register facing page

Diagnosis	**Treatment**						**Referrals**	**Re-attendance**
Others specify	Cons	Ext	Pros	Scaling	Other-specify	Surgical procedure specify		Date Complication, if any specify
(7)	(8)						(9)	(10)

6.1.5 Pilot-testing carried out after design and development

Large programme interventions involve huge inputs in terms of time, personnel and materials and unlimited finance. It was thus deemed necessary to pilot-test the HMIS before country-wide implementation. Interviews convened at all levels as well as FGDs show that the management system was pilot-tested with different personnel in different capacities from primary to tertiary level.

According to Health Research for Action (2000), a pilot-test co-funded by DANIDA (MTUHA Version 1.0) was initially done in 1986-88 in Mbeya rural District. Subsequently the pilot was further developed and tested in 1993 in the then 7 districts of Mbeya Region (Mbarali district was part of Mbeya rural district until separation in 1996). Finally between 1994 and 1997, with support from several donors (see Panel 9 HMIS Funding) MTUHA Version 1.0 was introduced countrywide and had been implemented in all districts in the country (114 at that time). However, not all non-governmental health organisations are implementing MTUHA.

The HMIS has been implemented hierarchically, and responsibilities are distributed on the same basis. At the national level, the Ministry of Health, Ministry of Finance and Planning Commission are involved together with international organisations and voluntary agencies. Similarly, at the regional and district level, the RHMT and DHMT are charged with the smooth running of the system, while at the bottom level, health centres and dispensaries are the core implementers. The process of country-wide implementation of MTUHA will be unfolded in sequence below (sections 6.1.7 to 6.2.8). It should be borne in mind that all procedures and tools involved in the country-wide implementation were subjected to initial and subsequent pilot-testing before being fully adopted.

6.1.6 MTUHA Pilot-test review

It was considered important to review the implementation of the piloted MTUHA. A seven-day workshop was conducted for this purpose at Kunduchi Beach Hotel. This meeting included the working group, various stakeholders and donors, the District and Regional Health Management Team members from the pilot region and districts involved in the training and in the comprehensive supervision. MTUHA was found to be more beneficial than the previous reporting system. (personal communication with DMO Mbeya district).

6.1.7 Country-wide implementation of the Health Management Information System

The Ministry of Health prepared an implementation plan (see Panel 7 below), which set a timeframe for chronological completion of activities by all the regions (Ministry of Health, 1994) with the following structure:

Panel 7 Plan of action for HMIS implementation

Months	Activity
First month	Preparation at national level
Second month	Training of regional team (10 days) and preparation at regional level for district team training
Third month	Training of district team (10 days) and preparation at district level for facility workers training
Fourth month	Training for facility workers (6 days) followed by immediate use of HMIS data collection tools
Sixth month	National team visit to regional teams to train on computer and supervise HMIS data entry on computer

Source: HMIS protocol (Ministry of Health 1994)

To facilitate implementation of activities regardless of funding donor, regions were divided into six groups and the scheduling of the completion of activities was determined (Ministry of Health 1994 - see panel 8 below). With the exception of Kilimanjaro, Tanga, Ruvuma and Dodoma regions, most of the regions implemented the plan according to the schedule, finishing their tasks even inside the specified timeframe.

Panel 8. Plan for HMIS implementation by Region

Step	Regions	Schedule
1	Mbeya	Feb-Jan 1994 (actual completion May 1993)
2	Rukwa, Iringa, Lindi, Mtwara	Sept 1993-Feb 1994 (actual completion Jan 1994)
3	Pwani, Singida, Mara, Mwanza	Aug 1994-Jan 1995 (actual completion Aug 1994)
4	Shinyanga, Arusha, Morogoro, Kagera	Feb 1995-July 1995 (actual completion June 1995)
5	Kilimanajao, Tanga, Ruvuma, Dodoma	July 1995-Dec 1995 (actual completion Jan 1996)
6	Dar es Salaam, Tabora, Kigoma	Dec 1995-May 1996 (actual completion April 1996)

Source: HMIS protocol (Ministry of Health 1994)

6.1.8 Health management information system funding

According to the reviewed literature and the in-depth interview conducted with Ministry of Health officials, the designing and implementation of the IS would not have been possible without the assistance from a variety of donors who committed themselves towards assisting the implementation countrywide. Despite several donors being involved, DANIDA remained the main funding donor, through the primary health care support programme (PHCSP) covering Arusha, Pwani, Mbeya, Rukwa, Kagera and Shinyanga regions (Ministry of Health 1994). On top of supporting these six regions, DANIDA continued to support the Department of Statistics, Information and Research in all aspects of the implementation of the HMIS (Ministry of Health 1994, Health Research for Action 2000). Other areas supported included equipment provision, transport and training costs. Similarly areas related to supervision at regional level, including the costs of computers and health information experts, were also covered (Ministry of Health 1994).

UNICEF was committed to supporting six regions in the implementation process: Iringa, Mara, Morogoro, Mtwara, Mwanza, and Ruvuma. The National Nutrition Programme funded by the World Bank supported four regions: Kigoma, Lindi, Singida and Tabora. Funding for the remaining four regions of Dar es Salaam, Dodoma, Kilimanjaro and Tanga were sought from existing donors in those particular regions. The donors were Swiss AID, the Italian development agency funding Dar es Salaam and Dodoma respectively and the German Agency for Technical Corporation (GTZ) for Tanga and Kilimanjaro. In addition, funds from the National Nutrition Programme were also rendered to support these four regions. The Ministry of Health has published the plan for funding HMIS implementation (see Panel 9 below).

Panel 9. HMIS Donor Funding by Region

Region	Supporting donor
Arusha, Pwani, Mbeya, Rukwa, Kagera, Shinyanga	DANIDA
Iringa, Mara, Morogoro, Mtwara, Mwanza, Ruvuma	UNICEF
Kigoma, Lindi, Singida, Tabora.	World Bank (through National Nutrition Programme)
Dar es Salaam, Dodoma, Kilimanjaro	Swiss Aid and Italian Development Agency
Tanga, Kilimanjaro,	Germany Agency for Technical Cooperation

Source: HMIS Protocol (Ministry of Health 1994)

6.1.9 Data handling and transmission

The Ministry of Health describes district hospitals, district-designated hospitals, other hospitals in the district, health centres and dispensaries as health facilities. The activities of these facilities include data collection, compilation and analysis, suggestions for HMIS tool modification, utilization of information for planning and management of health services at the health service facility, and also storing data and information (Ministry of Health 1993a). The activities assigned by the ministry of health to health facilities are in line with the findings of the study where primary facility workers collected and aggregated information before transmitting it to the next level above). According to informants from interviews and FGDs, some of the information is utilised for day-to-day activities in the facility.

As mentioned earlier, all data collection for MTUHA referred to in this study is primarily generated from primary health care facilities (a hospital-based information system came into being in 2001). Clients are provided with cards at different sections of a health facility. The cards require specific information according to the requirements of that particular section's or programme. Clients' particulars are then recorded in a related register and also tallied accordingly (some registers are provided with separate tally sheets while others have them. No register is provided for the laboratory records; rather, only a format is supplied for workers to adopt. (Some of the tools for data collection and compilation, such as client cards, forms, register and tally sheets, were provided in section 6.1.4 and others are appended in Appendix viii).

Additional findings show that although there is similarity in the pattern of information transmission between health centres and dispensaries, differences in data handling do exist. One difference is that all workers responsible for compiling information at a health centre submit their reports to the Medical Recorder for further compilation and submission to the in-charge who finally submits them to the DHMT. On the other hand, at the dispensary the MCHA and/or Medical Attendants submit their reports direct to the in-charge (head of facility), who finally submits them to the DHMT. The number of sections and health workers available in a particular facility determines the differences. The time schedule for submission of MTUHA reports has been organised by the MoH and clearly stated in facility book 10. Consequently, primary facility workers are supposed to submit their report at the latest by the 5th of the coming month, the district submits its compiled report to the region by the 15th of the same month, and the region submits its report to the Ministry of Health by the 25th of the same month. The delays in this schedule by almost one month before a report is available at the level of the Ministry of Health could affect some decision-making. Although the information system is computerised from the regional level upwards, delay of information still occurs. Kalowela (2001) provides a schematic diagram of information management in a Tanzanian health facility (Figure 6 below).

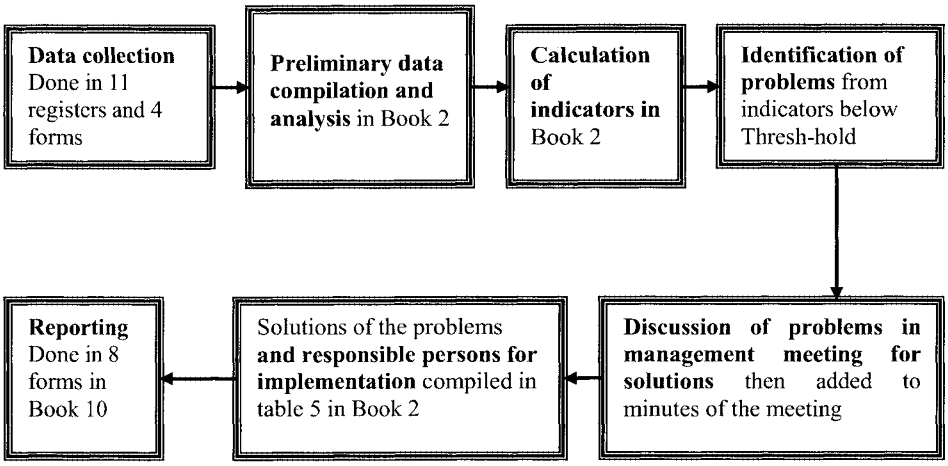


Figure 6 Information management in a health facility in Tanzania: Source: Kalowela 2001

A person known as an 'MTUHA Processor' is positioned at the district and regional levels. The role of the processor, among other normal administrative duties, includes receiving, entering and processing MTUHA data sent from primary facilities and districts respectively, and also submitting the reports to higher levels after they have been approved by the DHMT and RHMT respectively. On top of their normal training, MTUHA processors received special training, including training in data entry, analysis and computer skills. Thus they are the persons with most technical knowledge as regards MTUHA issues.

Since the inception of MTUHA, all regions have been provided with computers for MTUHA data entry and processing. The aim was to speed up the transmission of HMIS reports from the regions to the centre. For the same purpose, currently the districts have also been provided with such facilities. However, for technical reasons the computers have yet to be installed and equipped with appropriate programmes, even after a good number of months (personal observation). As such information storage and retrieval are still in very poor condition as can be seen from illustration 9 below.

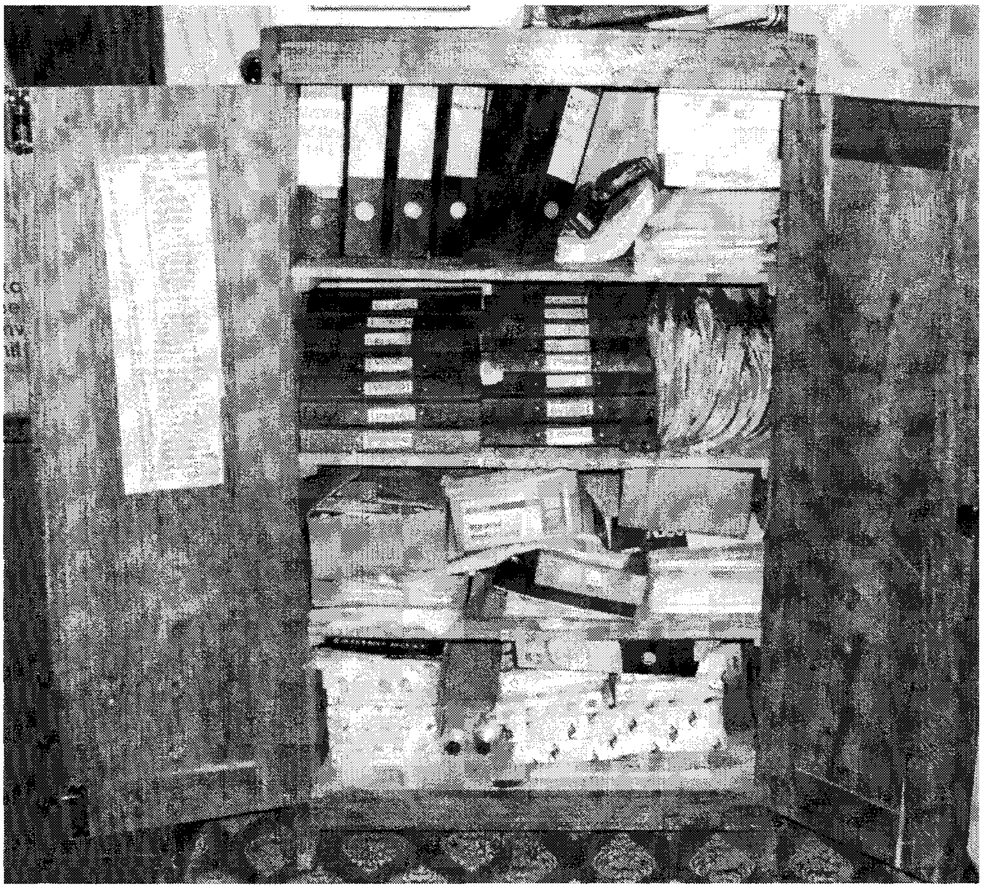


Illustration 9. A cupboard showing data and information storage at district level

6.2 Duration of information compilation and submission

In dealing with information compilation and submission, facility workers were asked the following questions: *how long does it take to compile the quarterly report? When are you supposed to send the report to the next level? What could happen in cases of delays in submitting HMIS report to the next level?* Also, *what actions are taken in case of delays in submission of HMIS report?* These questions will guide us in this section.

Primary facility respondents gave different responses to the question about the time they take to compile data for the quarterly report. Of the total 60 PHC respondents, the great majority, 46 of the take between 1-3 days to compile their reports, while 9 take more than 3 days. The remaining 5 respondents were not involved in report compilation (see Table 4 below). There was variation according to specific role: 18 out of 23 Clinicians took between 1-3 days while

4 took more than 3 days. 11 out of 15 Public Health Nurses 11 took 1-3 days, while 4 took more than 3 days. 8 of the 12 General Nurses 8 took between 1-3 days compared to one who took more than 3 days; 3 General Nurses were not involved in report compilation. On the other hand, nine of the ten Laboratory and Medical Record Assistants 9 took between 1-3 days, while one was not involved in the report compilation exercise.

Table 4. Distribution of respondent by time taken to compile primary facility data
n= 60

Respondents title	Time for compiling report			Total
	1-3 days	More than 3 days	Not involved in reporting	
Clinicians	18 (78)	4 (17)	1 (4)	23 (100)
Public health nurses	11 (73)	4 (27)	0 (0)	15 (100)
General nurses	8 (67)	1 (8)	3 (25)	12 (100)
Lab and record assistants	9 (90)	0 (0)	1 (10)	10 (100)
Total	46 (77)	9 (15)	5 (8)	60 (100)

The findings in the variation in time taken to compile report among PHC workers: perhaps the difference in tasks and type of clients in the different sections in a health facility has an impact on depending on time to compile report. This particular kind of analysis on compilation of report has never been reported in other studies, which were reviewed. However, the review by Health Research for Action (2000) found that many staff in the dispensaries and health centres had to work extra hours in the evening and some weekends in order to keep up with their documentation after the patients were dealt with. One factor is that working days for facility staff in the peripheral facilities are often filled up with patient care responsibilities. Another factor was that the lower levels of the system have the largest number of registers, forms etc. to complete for MTUHA and other multiple information systems (Health Research for Action 2001).

Submission of report: From the data analysis, it has been found that there was marked variation among health workers on when quarterly reports should be submitted to the next level. Of the 60 respondents 42% said that they submit their report at the end of every quarter, while 47% said they submit at the beginning of every quarter, 8% are not involved in reporting and 3% were not sure about the timing for report submission. In relation to job title, the variation among those who submit at the end of every quarter compared with those who submit at the beginning of the next quarter was as follows: of 23 Clinicians 39% vs. 56%, 15

PHNs 33% vs. 67%, 12 General Nurses 33% vs. 33%, and 10 Laboratory and Medical Record Assistants 70% vs. 10%.

The variation can be explained in three ways: the first group consists of those who work in sections of a health facility and submit their reports to the Medical Recorder, who compiles and submits them to the In-charge of the health facility. Thus they are more likely to submit their reports at the end of every quarter. The second group is those who compile and submit directly to the In-charge of the facility, and the third group is those who are In-charges themselves and submit their report to the DHMT at the beginning of every quarter. The last two groups are more likely to submit their reports at the beginning of every quarter. This constitutes one very important finding of this study. Similar studies conducted in Tanzania concerning HMIS (Health Research for Action 2000, Kolawela 2001) failed to discover this very important area of information flow that could delay report submission to the next level.

Consequences of delays to submission of reports: Primary facility workers were aware of the consequences that could occur in cases of delays in submitting reports to the subsequent level. Of the 60 primary facility workers 45% realise that delay in submission of a sectional report will delay compilation of the facility report, 43% that delays result in delays in district report compilation, and only 3% (two) of the respondents were aware of the resulting lack of provision of necessary supplies from the district. As shown in Table 5 below, the variation in perceived consequences of delays in report submission are mainly from delays in compilation of report at that particular level as well as the successive levels.

Table 5. Primary health workers' perceived consequences of cases of delays in submitting a quarterly report to the next level

n= 60

Consequences	**no. of responses**	**%**
Delay in compilation of facility report	27	45
Delay in compilation of district report	26	43
Don't know	5	8
Facility will not receive supplies	2	3
Total	**60**	**100**

The findings give an implication that facility workers have variable knowledge on the impact of delaying submitting their reports to the next level above. Similar observations have been reported by (Health Research for Action 2000).

Actions taken for delaying reports: From the study findings, it has been reported that measures taken to ensure that In-charges of health facilities submit reports on time have included verbal warnings, and stoppages of monthly salary until the report has been submitted. Salary stoppage is popularly known as "SP" according to how it appears in the salary data sheet. Other measures include follow-ups by the DHMT members and written warnings if habitual delays have been noted. In most cases, salary stoppage is applied to the in-charge of the health facility, as they are the ones entrusted with smooth operation of the facility. Table 6 below shows respondents' observations on actions that could be taken in case of report delays.

Table 6 Distribution of respondents according to actions taken in cases of delays in submitting reports

n= 60

Actions	no. of responses	Percent
Verbal warning	17	28
Payment stoppage "SP"	11	18
Don't know	20	33
Follow-up by DHMT	4	7
Written warning	8	13
Total	**60**	**100**

This table displays the various actions that could be taken if reports from a health facility are not submitted on time to the next level above. The finding implies that workers are not simply left to delay reports without any justifiable reason.

Figure 7 below is a schematic information flow from the lower level as observed by Health Research for Action (2000), during their review on the same information system. This Figure also shows the method used to collate data at various levels. Whereas Figure 6 (section 6.1.9) showed information management as described by Kalowela (2001). The two patterns give an insight into how information is handled and transmitted at the primary care facility above. The flow of information revealed by Health Research for Action (2000) and Kalowela (2001) are similar to the findings of this study. However, they do not consider the flow of information within health centre sections. Information flow within the health facility has been found to be crucial especially when it comes to timing of submission of information to the next level above. Campbell's (1997) study of the information system in lower-income countries such as Ghana and Nepal revealed similar findings.

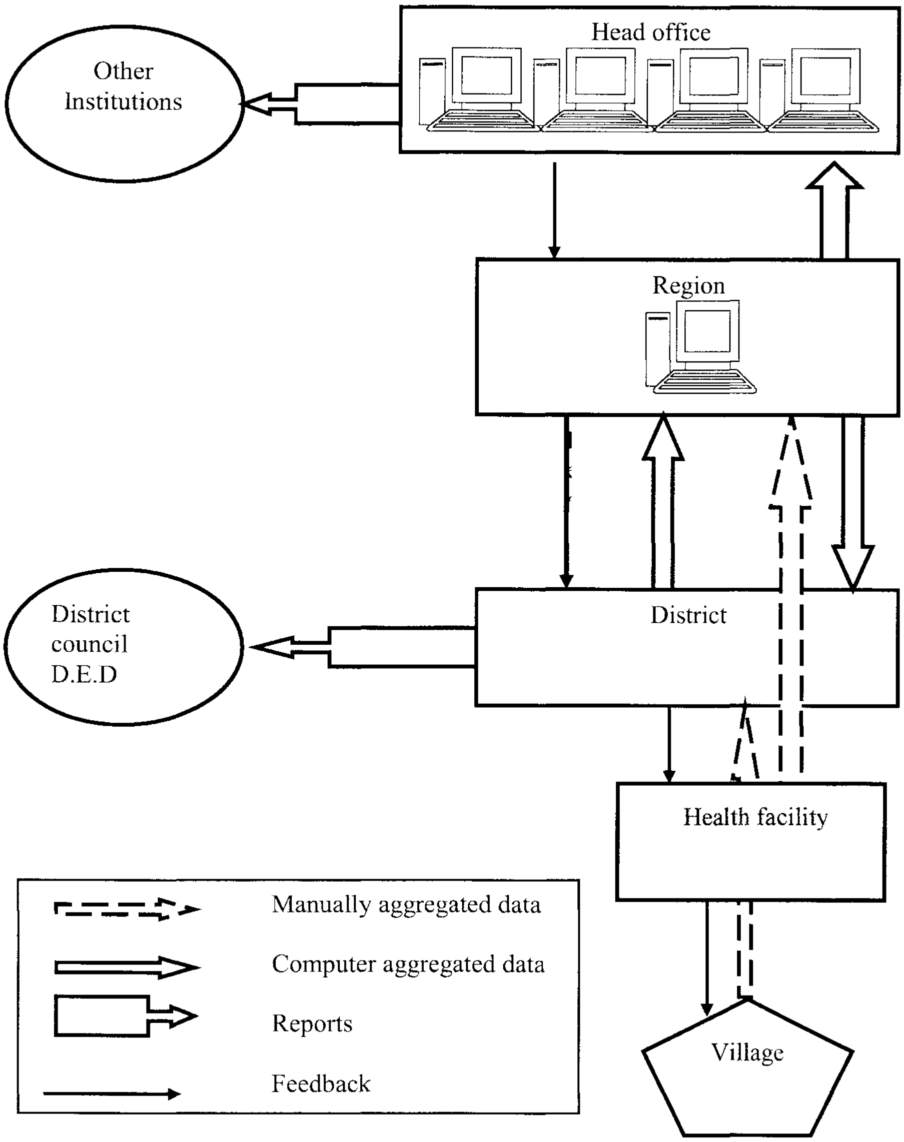


Figure 7. Information flow and method for information compilation: Adopted from Health Research for Action (2000) and graphically modified

6.3 Types of data collected at primary health care facility

Health information is generated from health facilities, health projects and programs. This study has dealt only with information generated from primary health care facility levels. Various sections, such as maternal and child health, out-patient departments, in-patient departments (only in health centres), and health and sanitation are found in health facilities. Various instruments are used to collect routine health data, such as client cards, tally sheet forms and registers. At the end of each working day, or at the end of the month, some data are aggregated and entered into report forms or registers. However, this depends on the nature of the information as well as information requirements at that particular or the next level. Similarly, reports are produced according to need, which might be on a daily, monthly, quarterly or even annual basis.

Such information has been regarded as excessive, consuming most of the workers' time. However, compared to what was demanded in the previous systems, the amount of information required remains relatively small (Health Research for Action 2000). Likewise the current system collects only necessary data for use at different hierarchical levels. Illustration 10 below is a list of types of data collected at primary level of health care according to respective sections.

Illustration 10. Type of information collected at primary facility

Administrative
- Facility workers' inventory
- Promotions
- Training
- Annual leave schedule
- Workload
- Stores and other

Out-patient
- Out-patient data
- Referrals

Maternal and Child Health
- Child vaccination data
- Growth monitoring data
- Diarrhoea case management
- Maternal vaccination (T.T.)
- Family planning data
- Ante/postnatal care data
- Outreach and mobile clinic data

In-patient
- Maternity and newborn data
- Female patient data
- Male patient data
- Child patient data

Health and Sanitation
- Community outreach
- Infectious disease

Laboratory
- Patient investigations and results

6.4 Variation in ability to collect data

The study has found that there is a variation among facility workers, irrespective of their roles, in their ability to collect data. For example, maternal and child health aides in a health centre, unlike their colleagues in a dispensary, are only competent to collect data related to MCH services. On the other hand, maternal and child health aides in dispensaries, although non-medically-trained, take the roles of clinicians when the clinicians are for some reasons away from the facility. In other words, they know how to collect various kinds of data required by the HMIS, though of poor quality. The same applies to nurses in the same settings. On the contrary, clinicians working in health centres are mostly competent in collecting data related to curative services, while those in dispensaries have the ability to collect all kinds of data. This can be attributed to the reasons explained above. Facility workers who had the chance to attend formal HMIS training are able to collect all kinds of data in a health facility.

The above information was also revealed in the group discussions that were conducted. For example a nurse-midwife commented as follows: "As a nurse I do collect from patients information related to diseases; in the maternity ward we obtain information on deliveries such as stillbirths, number of deliveries, kind of babies delivered as well as their condition during and after delivery - basically this information is crucial for our work". Another NMW said: "I collect data on diseases, compilation of which makes it easy to know the prevalence of diseases in our societies; hence we can make plans from the data".

A maternal and child health aide revealed: "I do collect data related to MCH services such as child vaccination status of women and children, weight of children and pregnant women, and monitoring of pregnant women vaccination during pregnancy. We compile some of the data according to indicator requirements and send them to the next level and use some of it for our day-to-day plans". Another MCH said: "I do collect maternal and child data such as vaccination, family planning and weight measurements. We also visit villages to conduct outreach services. I also collect data from TBAs related to home deliveries and deaths. The collaboration with TBAs makes us know occurrences of maternal deaths at home as well as immunisation coverage. In addition we also get data essential for assessing utilisation of services by women: Tetanus Toxoid (TT) vaccination, and family planning. We also visit schools to give TT to schoolchildren."

A clinical officer (CO) reported that as a clinician, he attends patients and collects patient data. He further says: "I make tallies, record patients' names, type of disease, type of drugs prescribed, and make patient totals at the end of the day likewise the end of the month. We as clinicians submit all registers to the recorder who compiles all the reports and submits them to the In-charge of the facility for further submission to the DHMT".

6.5 Quantity of data collected by the information system

This study has revealed that there is great variation in the amount of data collected at different sections of a primary health facility. The amount of data depends greatly on the data requirement of the existing programme in a particular section of a health facility. For example, the data requirement in the Maternal and Child Health (MCH) section is huge compared with what is required in, for example, the In-patient Department or the Laboratory. More programmes exist in MCH sections than in the other sections as Illustration 9 above partly shows. Similarly, different members of staff bear different burdens in collecting the data. The amount of time taken to collect and analyse data on request can be judged by the amount of data. The quantity of data collected in a section also determines the speed of information flow within the facility as well as speed of transmission to other levels. Similar observations have been reported in Bhutan (World Health Organisation South East Asia Region Office 2002). Similarly, in another setting, nurses were found to be spending up to 40% of their time filling in forms demanded by superiors (Braa 1995). In South Africa, the number of registers varied from site to site, ranging from 45 to 76 at each primary health centre, with 9-12 to support the family planning programme alone (Moidu 1993). Other sources, (Schware 1987, Smith 1987, Sandiford et al. 1992, Health Research for Action 2001 as well as the World Health Organisation (2002) have found that the large quantities of data collected by PHC workers consume plenty of time to collect and compile them.

6.6 Ability of the health information system to collect necessary data

In order to assess the amount of data required by the system, one facility book was reviewed (Book 10). The book contains instructions on what data should be collected at every section and when data should be submitted to the next level (MTUHA Version 2.0). Moreover, the tools used to collect the data in each section of the facility were examined for the same purpose. In addition facility workers were asked to give comments on the ability of the system to collect data. The results are displayed in Table 7 below.

A variation of perceived ability to collect data has been found among PHC respondents. Of the total of 60 primary facility respondents, 47 consider that the current HMIS obtains all the necessary information required compared to only 7 and 6 who considered that the system collects less and more than necessary respectively. The findings concur with those from the FGD, in which most of the respondents commented that the system collects most of the data required. However, data collecting deficiencies in the system were cited, mostly in respect of the Laboratory and MCH sections.

Table 7. Primary facility health workers by title in relation to the ability of HMIS to collect necessary data

n=60 (%)

Respondent's title	HMIS ability to collect data			Total
	All data required	Less than required	More than required	
Clinicians	15 (65)	4 (17)	4 (17)	23 (38)
PHN	14 (93)	1 (7)	0 (0)	15 (25)
General Nurses	11 (92)	0 (0)	1 (8)	12 (20)
Lab. and Rec. Asst.	7 (78)	1 (10)	2 (20)	10 (17)
Total	**47 (78)**	**6 (10)**	**7 (12)**	**60 (100)**

The in the table above findings displayed in the table above implies that primary facility workers are satisfied with HMIS and so have a positive attitude towards the system.

6.7 Quality of data collected

According to Farnham and Harton (1996), the word quality has featured prominently in the vocabulary of public services since 1990. Quality Cycles, Quality Assurance, Quality Management, Total Quality Management and other quality phrases are in fashion. Quality is also difficult to define; however, the European Organisation for Quality Control sees it as the totality of features of a product or service that bears on its ability to satisfy the given needs (Farnham & Harton 1996). Quality assurance can be defined as all the activities that have been taken to predict and prevent poor quality (Øvretveit 1992), whilst in health services, the quality has been defined as requirements that are fully met at the lowest possible costs.

Donabedian (1980) identified three dimensions of quality in relation to service. These include the technical (what), non-technical (how) and setting or amenities (where) of the service.

Stewart and Walsh (1989) adopt a similar framework to Donabedian but talk of the core service, core surroundings and the service relationship. In other words, Quality can then be seen as the standard expected in each element of the process of delivery service (Stewart & Walsh 1989; Ministry of Health 2000). In the same way, Øvretveit sets quality in three dimensions: client quality, professional quality, and technical quality (Øvretveit 1992). Because of these variable characteristics, quality in service has a large subjective element and is ultimately a matter of judgement rather than an objective measure.

Additionally, Farnham and Harton (1996) conclude that behind the concept of technical quality lies the idea that a quality service does what it is intended to do, which quality "gurus" refer to as 'fitness for purpose' (e.g. Deming 1986 cited in Farnham & Harton 1996). Similarly, different techniques for assessing quality of information have been recommended (Donabedian 1980, Symons & Walsham 1991, Husein et al. 1993, DeLone et al. 1992, Pitt et al. 1994b, Bonner 1995, Ballantine et al. 1996, Seddon 1997, Adelakun 1999, Cronk 2000, Turunen 2001). In addition, DeLone and McLean (1992) argue that information quality represents a measure of information system output. Typical measures in this area include accuracy, precision, currency, timeliness, and reliability of information provided. Thus since the data in the HMIS are not completed on time, are incorrect and are not clean, their reliability is very doubtful, which might affect their usability (Bonner 1995, Seddon 1997).

Despite these diverse interpretations or more appropriately perspectives on quality, the quality of HMIS information in this study fulfils the requirement of the proposal for HMIS. It states and emphasises that the collected data should be *clean*, *complete* and *correct*. In addition to these three requirements for quality of data as mentioned in the proposal, given the scope of this study, it was necessary to consider extra variables. The additional variables included the respondents' level of education, their professional training and knowledge of the information system (formal training or briefed by co-workers), the attitude of facility workers towards the information system, the supervision of health workers by DHMT and salary motivation. Various studies have also considered information system satisfaction, motivation as well as knowledge of the system as measures of quality or information system success (Bonner 1995, Ballantine et al. 1996, Seddon 1997).

Information on the quality of data collected was obtained from both individual interviews and the FGD employed, whereas only FGDs were used to obtain respondents' perceptions on supervision carried out by the DHMT. It is feasible to ask whether the data and reports provided by primary facility workers meet the criteria for data quality set in the MoH's HMIS proposal.

6.7.1 Completeness and correctness of data, cleanness of data collection tools

As mentioned elsewhere, in order to assess the quality of data collected by use of checklist, tools for collecting data for the months of January, April, August and December for the year 1998 were assessed (for the checklist see section 5.8.3).

The DHMT is supposed to visit and supervise facility workers at least once every quarter as a matter of routine. During the visit, among other things, supervisors are supposed to inform the health facility workers of any DHMT responses and of potential solutions to previously identified problems, as a kind of feedback. The findings on completeness, correctness and cleanliness as explained below are summarised in Panel 10 and in Appendix viii.

Completeness of data: The assessment of data collection tools revealed that generally there is incompleteness of data, which renders the data collected of poor quality. Registers, forms and tally sheets as well as tables in reports books are not as complete as required. For example, at the OPD each practitioner is supposed to use his / her own register in every month. Instructions are given on what should be completed and how this should be done, and also on how frequently each indicator should be calculated and reported to the higher level. However, in contrast, in every facility visited there were incomplete elements varying from missing records of the name of the clinician responsible for that particular register to improper and incomplete recording of medicines. In a few cases, the patient's serial number or the date when the register was started and ended were not completed as instructed. Other disparities included errors in calculation of some output indicators, and inclusion of administrative and logistical statistics that should be completed in Book 2 (Health Facility Data).

It was also surprising to find in one of the districts under study only partial completion of the district vaccination coverage graphic, which is supposed to show vaccination coverage of children under one year for the year 1999. The incompleteness was observed during data collection for this study in May 2002 (see Illustration 11). At the district levels and higher, reports are not completed in time, because reports from lower levels are received late or with inconsistencies which need clarification before a comprehensive district or regional report can be produced for submission at the national level.

A similar situation has been reported in Kenya, where the district reporting rate is below average, except for dispensaries, which have a reporting rate of 64.7%. This compares to 33.1% for hospitals, 39.2% for health centres and 25.7% for nursing homes (Mordue 2001). The report concludes that this is a clear indication that the district data are incomplete and inaccurate.

In conclusion, existing discrepancies in data quality have been observed in all data collection tools in all sections of health facilities. Similar discrepancies prevail at the district and the regional level, and at the Ministry of Health. Such discrepancies have led to delays in production of the HMIS abstract produced by the Ministry of Health, and even when it is finally produced, it remains incomplete in parts. These findings agree with the findings of the report by Health Research for Action (2000). Such discrepancies in data quality recall the famous comment by Sir Josiah Stamp: "The authorities are very keen on amassing statistics. They collect them, add them, raise them to the n^th^ degree, take the cube root and prepare wonderful diagrams. But what you must never forget is that every one of those figures comes from the village watchman, who writes down what he damn pleases" (Quoted in Heywood et al. 1994).

The illustration below shows an example of discrepancy in data quality (incompleteness) at the district level wherein the graph and tables are not completed.

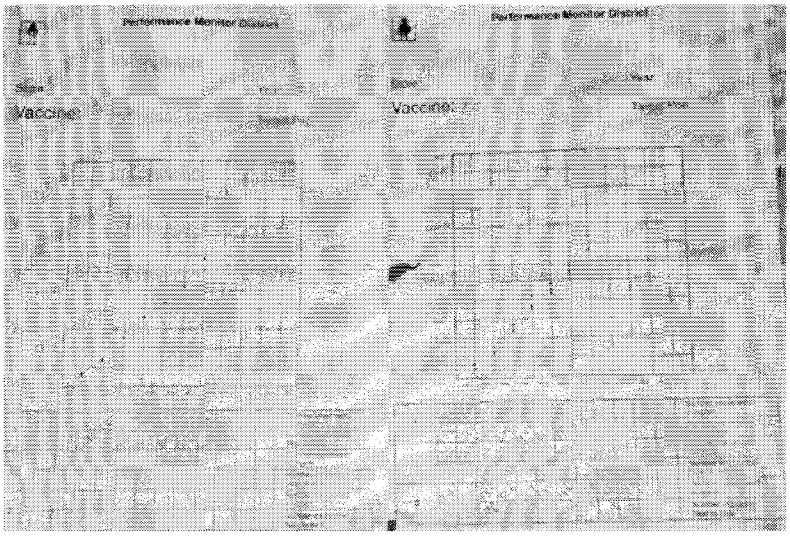


Illustration 11. Incompleteness of BCG and Polio vaccination performance monitor chart at district level for the year 1999. Photo by Mshana May 2000.

Correctness of data: Another inconsistency in data quality found in this study is incorrectness of data, rendering the quality of the data dubious. Incorrectness of data (errors in simple addition and subtraction) was prevalent at some facilities. The main recording errors were found with vaccines, family planning pills and condoms in MCH records. Symptoms of disease are also often reported instead of actual diagnosis. Irrational use of medicines and recording contrary to the HMIS instructions were other inconsistencies in quality: wrong medicine given in relation to a (probably correct) diagnosis, or more than one kind of medicine being recorded on the same line, which is contrary to HMIS instructions (see Panel 10). Another example is the incorrect reporting of the unit of measurement of Chloroquine phosphate and Cotrimoxazole syrups unit in terms of teaspoons instead of millilitres. In support of these claimed discrepancies of data, the following illustration shows discrepancy in data accuracy.

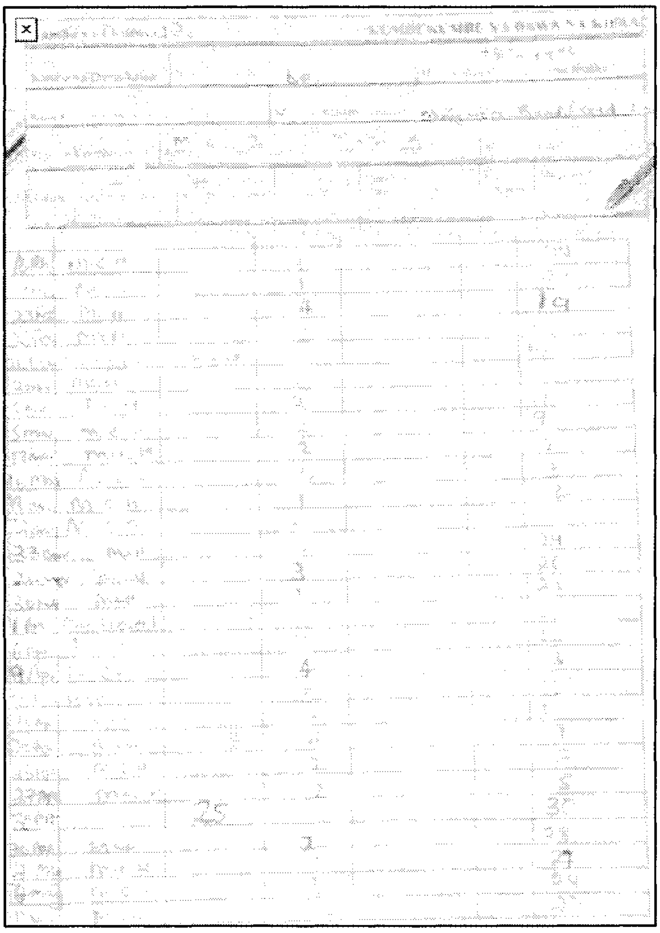


Illustration 12. Drugs and equipment form displaying incorrectness of data in a health facility (see dates Aug 19th and 22nd). Photo by Mshana. May 2000.

Cleanness of data collection tools: The data collection tools in every facility visited failed to meet the criteria for quality of data as per the HMIS proposal, although the level of cleanness varied between facilities (dispensaries to health centres) and among workers. Data collection tools at MCH clinics were the least clean. Generally performance on cleanness was unsatisfactory, as can be seen in Illustration 13. Other discrepancies are summarised in Panel 10 and appendix viii. Illustration 13 below shows lack of cleanness of data collection tools as observed in one of the health facilities.

Illustration 13. OPD annual report for children under five years: use of a data collection tool which is not Clean. Photo by Mshana May 2000.

Panel 10. Summary of quality of information with details of correctness, completeness and cleanness according to types of data collection tools examined.

Type of tool	Observed weakness	MTUHA recommendation	Remarks
Book 1 *(MTUHA guidelines)*	. no weaknesses *(all facilities have the book)*		
Book 2 *(health facility data)*	. not well completed in all facilities . incomplete reporting of patients attending OPD . incomplete MCH service tables 49M, N, O and P *(Simambwe, Izumbwe dispensaries.)* . no year of reporting on the book . cleanness of data not maintained . women do not attend after delivery (no comments made)	. tables must be complete, clean and correct . date and year of reporting must be recorded on the cover .cleanness of registers is important .all women are supposed to attend clinic for tetanus-toxoid	Despite the observed weaknesses, there were no comments made by DHMT members during their super-visions (either previous or following)
Book 3 *(community register)*	. reports incomplete in all facilities . incomplete information on village visits	. all tables should be completed appropriately	Inconsistencies of data completion continue to exist irrespective of routine supervisions

Owing to the limited space available in the text, further illustrations on quality (completeness, correctness and cleanliness) are added in Appendix viii.

Facility Workers' Level of Education: To obtain information on respondents' levels of education, respondents were asked: *what is your level of education?* In the Tanzanian context, where it is possible to repeat a class, this question makes more sense than asking *how many years did you attend in school?* In Tanzania seven years of primary education are compulsory. After passing a qualifying primary school examination, one is normally eligible for four years of secondary education. Depending on ability to pay, those who fail this examination have the opportunity to enter private secondary schools, but to do so they must have attained specified minimum marks. The next level is secondary high school (additional two years), which depends on both performance and ability to pay.

In this particular study six categories of education were set (see Appendix ii: questionnaire for dispensary and health centre workers); however, despite six categories being set, for convenience of analysis, respondents were recoded and classified into two categories: primary and secondary. Table 8 below shows that 52% i.e. slightly more than half of the 60 respondents had attained secondary education, while the remaining 48% had only primary education. A further point to note is that among respondents in the secondary education category, some failed to complete all four years of secondary education, and similarly in the primary education category, not all had completed primary school.

Table 8. Distribution of primary facility respondents by job title and level of education
n = 60 (%)

Respondent's title	**Level of education**		**Total**
	Primary education	**Secondary education**	
Clinician	6 (10)	17 (28)	23 (38)
PHN	10 (17)	5 (8)	15 (25)
General Nurse	8 (13)	4 (7)	12 (20)
Lab. and Med. Rec. Assts.	5 (8)	5 (8)	10 (17)
Total	**29 (48)**	**31 (52)**	**60 (100)**

Chi Square = 8.203, p = .042

Table 8 above shows that slightly more than half (52%) of the respondents had secondary education while the rest had only primary education. Level of education clearly has an impact on the undertaking of daily health care duties including collection, analysis and utilisation of data.

Professional training: A great variation in professional training among facility workers such as primary health workers, DHMT and RHMT members has been observed in this study. The variation ranges from no training (medical record assistants, medical attendants and laboratory attendants) to post-graduate training (DMO, RMO, Pharmacist and the TB & Leprosy Coordinator). In order to assess levels of professional training, respondents were asked: *how long was your professional training?* Some workers had undergone both basic training and further training (upgrading training): the most recent professional training counted. Four options were set according to the knowledge of the principal investigator on health worker training in Tanzania. These options were as follows: (i) no formal professional training, (ii) one year or less, (iii) two years and (iv) three years or above. For practical reasons, the training variable was analysed together with training on HMIS as shown in Table

9 below. Of the total (60), 50% had had professional training of less than 3 years. Their distribution according to job title was in the order of Clinicians 13%, PHNs 23%, General Nurses 2% (one), and Laboratory and Record Assistants 12%. On the other hand, 42% of the respondents had had more than 3 years of training; their distribution according to job title was Clinicians 25%, PHNs 2% (one), and General Nurses 15%. The remaining 8% of the total 60 respondents, 2 General Nurses and 3 Laboratory and Record Assistants, had had no formal training; job title variation is not shown in the table.

Table 9. Distribution of primary facility respondents by professional training and HMIS training n = 60

HMIS training	**Professional training**			**Total**
	No training	**Two years and below**	**Three years and above**	
Formal training	1 (2)	17 (28)	10 (17)	28 (47)
DHMT/co-workers briefing	4 (7)	13 (22)	15 (25)	32 (53)
Total	**5 (8)**	**30 (50)**	**25 (42)**	**60 (100)**

NB: In the analysis there were only three categories. "Two years and below" included respondents with one year of professional training.

Chi-square = 3,080; P, .214

The table above shows that half 30 (50%) of the respondents had undergone from one to two years of professional training, while slightly less than half 25 (42%) had more than two years professional training.

Training on Health Management Information System: According to all the types of data collection employed in this study (literature survey, FGD, in-depth as well as structured interview), before HMIS was introduced nation-wide, the RHMT together with the DHMT members were first trained by national trainers, and then in turn convened training for health facility workers (Ministry of Health 1994). Training in new knowledge, skills and innovation is critical for building workers' capacity, as it empowers them with contemporary knowledge and skills important for their daily operations. As stated above in the section on HMIS implementation, before implementation of the HMIS hierarchical training of health workers was convened. Training varied considerably in duration, with RHMT and DHMT members being trained for 2 weeks, while facility workers were trained for seven days (all workers of different job titles together). Therefore, in order to assess training on the HMIS among respondents, the literature was reviewed, and interviewed respondents were asked: *how did you get knowledge about HMIS?* Four options were available: (i) I attended formal training, (ii) I was briefed by district staff, (iii) I was taught during professional training, and (iv) I was briefed by PHC facility workers. The above training categories (i) and (iii) were recoded and termed formal training, and categories (ii) and (iv) were also combined and termed informal training. Additional exploration of training on HMIS was carried out during the focus group discussions.

The findings on training show that of the 60 primary facility health workers interviewed, 53% were not formally trained in MTUHA. There is also a great variation in training among workers within a facility and among facilities and also between levels. For example, in Ujewa mission dispensary only one person (MCHA) had been formally trained. Of the 12 General Nurses from primary facilities interviewed, only two of them (17%) were formally trained. A similar situation prevailed at the secondary level: of the 15 DHMT members and 10 RHMT members interviewed, 5 (33%) and 3 (40%) from the district and region respectively had not received formal training on MTUHA.

Concerns about the performance of untrained workers using MTUHA emerged during the FGDs. For example, one Clinical Officer complained "I am very much worried that some workers are not trained and don't know what will happen if those with training reduce their efforts on MTUHA." Similarly, an Assistant Clinical Officer (ACO) commented that "MTUHA is so difficult that even the district trainers do not understand it well" and gave as an example: "During MTUHA training, district and regional trainers contradicted each other causing some argument among themselves. Even today they just confuse us at times during their visits". The occurrence of confusion among trainers was supported by most participants in all PHC facilities FGDs. On the need for MTUHA training, the same Clinical Officer commented that "in fact we all need training, I mean the district as well as facility workers".

Furthermore, according to the Assistant Medical Officer (AMO): "Although many changes have been made in MTUHA, no formal training has been conducted since the last one in 1992. Therefore it is necessary to summarise all the new issues and conduct training on those points". The impact of non-training on the quality of data and overall MIS implementation as well as on supervision of both facility workers and the DHMT by RHMT members remains uncertain. More on the impact of training on the MIS will be brought out in the section on supervision as well as in the summary of the FGDs. In addition to the comments above on training in MTUHA across all levels, the findings among primary health facility workers are displayed in Table 10 below.

Table 10. Distribution of primary health facility respondents by title and training in HMIS
n = 60 (%)

	HMIS Training		
Respondent's title	**Formal training**	**DHMT/co-worker's briefing**	**Total**
Clinicians	13 (21)	10 (17)	23 (38)
PHN	10 (17)	5 (8)	15 (25)
General Nurses	2 (3)	10 (17)	12 (20)
Lab. & Med. Rec. Asst.	3 (5)	7 (12)	10 (17)
Total	**28 (47)**	**32 (53)**	**60 (100)**

Chi-square = 8.764, p = .033

Table 10 above shows that slightly more than half (53%) of the respondents were informally trained, compared to the remaining 47% who received formal MTUHA training. The results are statistically significant, implying that a majority of those implementing MTUHA did not receive proper training. These findings are consistent with those of the study conducted by Kalowela (2001), in Mbinga district, Tanzania, in which it is reported that only slightly more than half (52%) of the respondents' had received training in MTUHA. In that study, as in this study, the training is considered to be insufficient, and staff turnover is reported as high, resulting in staff who are untrained in MTUHA-related matters. Insufficient training had been carried out on compilation, reporting, analysis as well as on use of data, and what training there was had focused mainly on data collection. The problem with training in HMIS was not only found among primary facility workers: other levels such as DHMT and RHMT were equally affected.

In a Southeast Asia Region (SEARO) meeting, it was suggested that in order to strengthen health information systems, there is a need for all programme managers to be adequately trained in data management (World Health Organisation Southeast Asia Region Office 2002). A study by Lammintakanen et al. (2002) found that directors of nursing needed more information on the content of work in order to allocate resources effectively. Their interpretation was that directors of nursing had too little theoretical information about how to support their staff and their professional development, and how to allocate human resources in an appropriate way.

Knowledge of HMIS (ability to define it): In addition to responding to questions about how they had obtained knowledge of HMIS, primary health worker respondents were also asked to define it in simple terms (either in English or Kiswahili) by answering the question: *what is HMIS.* HMIS was correctly defined by less than half (28) i.e. 47% of the PHC workers interviewed. Of those who gave the correct definition, 21 had received formal training and 7 only informal training. This shows that those who were trained on the MIS had a higher chance of giving a correct definition compared to untrained ones.

The same result was clearly found among clinicians. Of all 23 clinician respondents interviewed, 11 (47%) had received MTUHA training: of these 9 gave the correct definition and only 2 failed to give the correct definition. By comparison, of the 12 (52%) clinicians who had not received MTUHA training, 7 gave the correct definition, and 5 mis-defined HMIS. (statistics for this example are not included in Table 11 below, which shows all respondents by HMIS training in relation to defining the HMIS.)

Table 11. Respondents by HMIS training in relation to defining the HMIS

n = 60 (%)

HMIS training	**Defining HMIS**		**Total**
	Correctly defined	**Incorrectly defined**	
Formal training	21 (35)	7 (12)	28 (47)
DHMT/co-workers briefing	16 (27)	16 (27)	32 (53)
Total	**37 (62)**	**23 (38)**	**60 (100)**

Chi Square = 5.948 P = .047

The table above shows that 37 (62%) correctly defined the management information system. Of these respondents, 21 (35%) had received formal training, while 16 (27%) had informal training. This implies that those who had received formal training were in a better position to give the correct definition.

Incentives for Motivation: Salary as an incentive was considered a factor that could influence workers' performance in undertaking their daily routine work and influence the quality of data collected. To assess workers' motivation, respondents were asked: *does your salary motivate you to work?* Two options were provided (yes and no).

The findings of the study in relation to incentives shows that of the total 60 (100%) primary facility workers respondents, 90% (54) were dissatisfied with their monthly salary (see Figure 8). In addition to de-motivation owing to meagre salary, facility workers during FGDs expressed their grievance that allowances payable for village visits (outreach), disease outbreaks and annual leave remained unpaid. Other chronic incentive grievances included subsistence allowances for transfers. The complaint about non-payment of outbreak allowances referred to allowances for campaigns to combat meningitis and cholera outbreaks in Ikukwa and Izimbwe respectively.

When asked during the FGDs about allowances for outreach, and in particular, about where the complaints should go, a typical response was: Basically our complaints go to the DHMT, and they have not even paid some of our dues such as transfer money, annual leave, and allowances for serving in disease outbreak camps (the cases of meningitis and cholera outbreaks cited above were given as examples)". This grievance was expressed by most of the facility workers Figure below shows that the great majority of the respondents were dissatisfied with their monthly salary, even though variation existed within and between categories of workers.

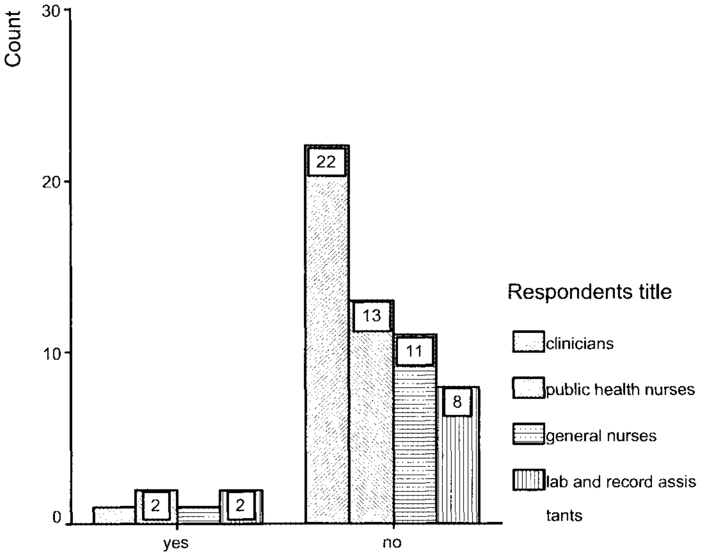


Figure 8. Facility workers satisfaction with monthly salary

The figure above illustrates the variation in workers' satisfaction with monthly salary, clinicians being the least satisfied. Of the six respondents who were satisfied with their salary, the figures according to job category were: a Clinician, two Public Health Nurses, one General Nurse and two Laboratory and Medical Recorder Assistants

Attitude of primary health facility workers towards HMIS: In order to assess the attitudes of respondents to the information system, the respondents were asked: *what do you think are the advantages and disadvantages of MTUHA as compared to the earlier reporting system?* As this was an open-ended question, blanks for recording opinions were provided. Responses were recorded and analysed in terms of frequency grouped according to corresponding themes and percentages calculated as illustrated in Table 12 below. These responses also measured the attitudes of facility workers towards the HMIS.

Table 12. Advantages of HMIS as perceived by facility workers

n=60

S no.	Responses	Percentage
1	Records well kept, easy to retrieve and make corrections	33
2	Data collected easily	30
3	Easy to assess prescription and consumption and plan ordering of medicines	28
4	Collects information from all sections in a single system	25
5	Data collected at the right time, easy to handle, reliable.	25
6	Easy for staff to report and measure individual and overall facility work performance	22
7	Shows disease trends, easy to locate epidemic in a community	22
8	Helps in decision making	10
9	Easy to know facility's target population and coverage	10
10	Puts staff to task (busy all the time)	7
11	Patient follow-up made easy (e.g. defaulters)	5
12	Teamwork among staff enhanced	3
13	Easy to make personal judgements	2
14	Bottom-up reporting system	2
15	Continuing education	2
16	Easy to measure number of procedures done	2
17	No advantages	2

In addition to the advantages listed above, respondents were also asked to mention disadvantages of the current HMIS. The comments on disadvantages, which also measured respondents' attitudes, are summarised in Table 13 below.

Table 13. Disadvantages of HMIS as perceived by health facility workers

n=60

S no.		Response	Percentages
1.	MTU HA	. large workload	22
		. involves lots of books	13
		. requires big number of staff	7
		. staff are kept busy filling forms, registers and reports	5
		. requires large amounts of data	2
2.	MTUHA Training	. not all staff were trained	13
		. needs skilled personnel	12
		. medical records staff not fully involved	3
		. not well understood by some district supervisors	3
		. difficult to compile reports	3
		. no refresher courses for facility workers	3
		. not well understood by facility workers	2
		. very technical system	2
		. needs regular seminars	2
		. disparities in on-the- job training by trained staff	2
3.	MTUHA Flexibility	. not action-led	8
		. difficult to monitor diseases by gender	5
		. limits staff to give only report required	2
		. limits upper level staff actions on lower level problems (each level is supposed to take its own actions)	2
		. does not aim at improving workers' benefits e.g. promotion	2
		. limitations in case management (specified drugs for diseases)	2
		. difficult to monitor staff not reporting as required	2
		. fails to consider incentives to facility workers	2
		. does not provide feedback	2
4.	Logistical support	.Tetanus Toxoid cards are not provided with space for recording doses administered to injured clients	7
		. no support for supervision e.g. bicycles	3
		. shortage of tally sheets, forms and registers	2
		. late distribution of equipments (March 2000)	2
		. no working tools e.g. calculators	2
		. does not ensure provision of supplies	2
5.	Miscellaneous	. supervision inadequate	2
		. difficult to implement in absence of teamwork	2
		. possibility to enter wrong/forged information	2
		. indicators measure disease at the same rates irrespective of differences in geographical disease distribution	2
		. creates long patient waiting time	2
		. provides large catchment area	2
		. frequent changes create problems in implementation	2
		. weak in recording Oral Rehydration Sachets during weekends	2

From the two Tables it is clear that there was variation in attitudes towards HMIS among primary facility workers, but nevertheless the majority had a positive attitude, since larger percentages (cells 1-5 in Table 12 above) gave positive comments towards the system than negative. The disadvantages given are very general and basically similar to those observed in many other studies.

6.8 Information utilization

According to the available literature, collected data are to be analysed and utilised at every particular level without depending on feedback from level above (Ministry of Health, 1994). Given this fact, facility workers were asked to respond in an open-ended way to the question: *how did you utilise the data collected?* Responses on how collected data are utilised are shown in Table 14 below.

Table 14 Respondents' responses concerning utilisation of information

n=60

S. no	Response	Percentage
1	Planning health education according to prevailing problems	28
2	Planning daily activities and proper record keeping	28
3	Planning to order supplies such as vaccines, drugs and reagents etc.	15
4	Don't know	13
5	Sensitising on service utilisation	10
6	Planning for village follow-up	8
7	Planning to control of disease incidences	8
8	Staff training according to identified problems (Continuing Education)	8
9	Developing strategies on how to monitor indicators	7
10	Sensitising women on importance of delivering in health facilities	3
11	Planning vaccinations	3
12	Research	2

Table 14 above shows that respondents use information in various ways, the variation being determined by the section in which the facility worker works. Of the total (60) PHC respondents, slightly over a quarter (28%) utilised the information for planning daily activities and record-keeping as well as for planning health education according to prevailing health problems. However, a surprising 13% of the respondents did not know how they should utilise the information. Those who did not know what to do with the data were Medical Recorders and medical attendants who in most cases are not directly involved in utilising information.

The findings also show that the information collected is being utilised for decision-making. The decisions made depended on the individual's role within the heath care system. The kind of decisions mentioned were: decisions on types and amounts of drugs to order (Clinicians), types of vaccines and amounts to order (MCHAs and PHNs), decisions to re-plan to meet unmet goals, decisions on when to do follow-ups of different MCH service clients (MCH In-charge), decisions on staff logistics such as annual leaves, staff to be employed (Facility In-charge), returning of excess stocks (MCHA / Facility In-charge,) and how to keep records. The findings of Campbell's (1997) study in Ghana and Nepal were that a variation of information use existed across different actors at different levels. Unlike Campbell's (1997) study, no evidence was demanded from respondents so as to justify the use of information. Lack of demand for such evidence could be considered as one of the limitations of this study. However, the information obtained in the above manner can be considered reliable.

6.9 Supervision

The study findings show that on the basis of the reports sent to higher level, facility workers expect, among other responses, supervisory visits. It was reported in the group discussions that facility workers expect to be supervised at least once a month. However, scheduled visits are often missed, for reasons ranging from heavy rains that prohibit easy access to remote facilities to mechanical problems with transport. The Ministry of Heath has laid down clear guidelines for Primary Health Care supervision, in which it is stressed that the DHMT and RHMT should adjust the supervision checklist according to local needs. "The checklist model has been prepared to act only as a guide. It is expected that supervisors will prepare their own checklist based on the prevailing situation" (Ministry of Health 1999). During the focus group discussions it was revealed that some district supervisors are not competent in supervising some HMIS issues; however, the DMO, the District Cold Chain Operator (DCCO) and the District Maternal and Child Health Coordinator (DMCHCO) as well as the so-called MTUHA processor were reported to have more competence in the supervision role. Deficiencies arising included inconsistent advice from supervisors, lack of incentives for supervision (village visits) and lack of information on planned supervision schedules. It is therefore relevant to elaborate further on the inconsistencies.

Inconsistencies in advice: As mentioned above, the inconsistencies in advice that exist among the supervisors emanate from the fact that some DHMT supervisors are not trained in the HMIS, which renders them less competent to supervise its operation. Issues reported to show inconsistencies among supervisors included how to record the provision of Vitamin A capsules to women who deliver at home. Since there is no space in the MCH registers for recording the capsules issued, stock issued and stock remaining do not tally; supervisors' ideas on how to deal with the issue differ considerably. Additionally, advice on changes that had been incorporated in MTUHA Version 2.0, given during training conducted by the regional supervisors for district supervisors, proved somewhat inconsistent.

Supervision schedule: As mentioned above, the MoH has provided a well-planned supervision schedule. With exception of the MoH, which is supposed to support the region twice in a year, each level is supposed to supervise the next level below once every three months. Despite this planned schedule, there was variation among members of the RHMT and DHMT concerning frequency of supervision.

These variations included the times for starting supervision, and the distances of primary health facilities from district headquarters. Surprisingly, some members were unable to correctly give the distance of the furthest facility from the headquarters. Responses among 15 (100%) DHMT members interviewed showed that 67% did not know which health facility lay the furthest distance away from the headquarters. Timing of supervisions calls for knowledge of distance.

Another discrepancy in supervision concerned the time to start the supervision visit. Of the fifteen DHMT members, 33% considered 8 am the correct time, while the remaining 67% mentioned later times than 8 am. The time when the supervision should start has an impact on the supervision process; late arrival at the facility hinders the DHMT members from conducting a thorough supervision. In addition to the time to start supervision, DHMT members varied in the amount of time used to conduct supervision in a health facility: Of the total 15, 80% mentioned two hours, the remainder (20%) more than two hours.

These inconsistencies and variations show how members of the DHMT are not conversant with even simple routines. Similar discrepancies were observed among the 10 RHMT members interviewed: When asked how frequently they should supervise DHMT members, RHMT members responded in a variable manner: instead of the prescribed quarterly visit, 50% mentioned monthly visits.

Facility workers were asked several questions during focus group discussion to ascertain their attitudes, perceptions and opinions about the type of supervision and guidance they receive in their work. In response, facility workers complained that despite the proper schedules made for supervision, DHMT members do not inform them when supervision is to take place, so that the supervision takes the form of an ambush. Such supervision makes it difficult for some workers to respond to MTUHA issues, as the In-charge or person most competent in MTUHA is absent during the time when the supervision is taking place. Such supervisory trips were termed almost unproductive. The facility workers also complained of the late arrival of supervisors to their working stations; sometimes supervisors arrive late, and if they fail to find the worker in the area, even outside working hours, this causes problems for the worker, in most cases in the form of harsh words. As with the DHMT members, the findings of inconsistency in the frequency of supervision show how various members of the RHMT team are not conversant with basic MTUHA and organisational issues as a whole.

Incentives (allowances) during supervision: Probably the thorniest issue, which came up in all the FGDs, was allowances for supervision. Facility workers are concerned that supervisors from higher levels receive a certain amount of money as supervision allowance and overnight allowance where appropriate. But when it comes to the case of facility workers visiting villages for the same purpose, nothing is provided to them. One Clinical Officer complained: "this habit of paying workers at higher level and undermining PHC facility workers demoralises us to do village visits. It is better not to pay anyone, instead the money should be used to improve the quality services provided". Another said that "regardless of our levels we are all workers and our basic needs are the same, therefore we should also be considered for allowances when we perform similar roles alike to those performed by workers in higher levels". An MCHA reported that they conduct both mobile and outreach visits, but seldom receive money for outreach visits.

When asked whether the disparity in paying allowances affects their morale to perform their duties, especially with respect to outreach programmes, in different settings, facility workers responded: "in one way yes, sometimes workers refuse to go to faraway villages simply because they are not paid. In the past we used to get at least a meal from the village government, but nowadays they offer nothing." Another worker remarked: "we know that there is money allocated by higher levels, but we are surprised where the money goes!" Workers in mission facilities reported that they have no option but to do village visits as scheduled: "unlike in the public facilities, regulations here are so strict, the mission administration offers us transport and lunch if we have to visit distant villages."

Facility workers in public facilities further explained that before the current HMIS, they used to do most of the village visits, but after the introduction of HMIS and the granting of allowances to only certain categories of people, their morale is no longer as high as before.

When asked if they would improve frequency of village visits if some allowances were provided, the response was absolutely in the affirmative. Facility workers recommended that the DHMT should find some means to provide them with allowances for village visits conducted. On the other hand, the issue of who should pay workers in private health facilities caused some discussion. A consensus that the DMO should be responsible was reached after the following explanation given by one Clinical Officer: since mission hospitals are private and not-for-profit, assisting the government to render certain services, the mission administration cannot be expected to meet extra supervision costs on top of transport, fuel and lunch packages that are provided.

6.10 Developing models for health care information system evaluation

In developing the current Multidimensional Model for Health Information Systems Evaluation M-HISE 2003, it has been realised that the major problem behind developing a framework for evaluating HMIS in health care organisation is the complexity of the organisation itself. Different levels as well as departments are involved in an organisation. In particular, the departments require different data collection tools and use different staff and equipments, all of which necessitate different means of evaluation. Almost all the models explained in this dissertation so far attempt only to evaluate the information from a small part of the whole system, or test the existing model as a segment of the whole, adding some elements. The principal investigator has taken a deductive approach so as to develop the current model, which means that the model has been developed after the whole process of evaluating the health management information system has been completed.

Such an approach is acknowledged by other information system researchers: "many, although not all, qualitative researchers attempt to avoid prior commitment to theoretical constructs or to hypotheses formulated before gathering any data" (Yin 1984). In this way an inherent understanding of the organisation (environment, composition, and culture), the design and development of the information system and of other variables is assumed. The deductive approach is highly recommended to those who prefer to develop new models otherwise in case of testing of an existing model one does the opposite. Depending on the object of the evaluation, for example use of information, quality of information or monitoring (supervision) in HMIS, the framework is designed in relation to the organisation, the users of the system and what outcome measures are expected from the system. This has been characterised by Cronk as dimensions of the IS business value construct (see Panel 11 below). The construct is made up of value contributed by the technical system, the user and the business (Cronk 2000). The value fits quite well in the construction of the current HMIS model.

Panel 11. Cronk's dimensions of 'IS business value' construct

Aspect of Value (How value is added)	Dimension
Value attributed as a result of the type and characteristics of the system	System dependent
Value attributed as a result of the user characteristics	User dependent dimension
Value attributed as a result of the nature of the business (its strategy)	Business dependent

Source: Cronk (2000): Understanding Complex Information System Constructs through Holistic Construal.

Using a similar logic, Turunen (2001) has developed a model for the evaluation of health care information systems (Figure 9 below), along with specific models for evaluation of treatment or nursing information systems, and for the evaluation of diagnostic information system. The latter two are based on the first, which is a general model (Turunen 2001). Although unlike Cronk's model, Turunen's model is designed for evaluation of health care information system, it still contains some business elements, and is thus not entirely a Health Management Information System Model.

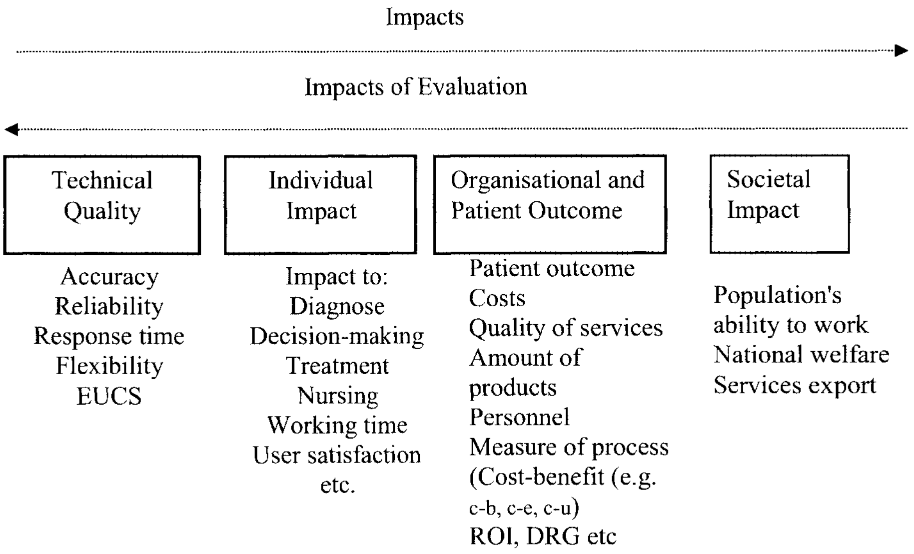


Figure 9 Turunen's Model for the evaluation of impacts of health care information systems. Source: Turunen 2001

Turunen (2001) identified and advanced attempts to bridge the existing gap on the lack of a universal model to evaluate health care information systems. Thus a Multi-dimensional Model for Health Information System Evaluating 2003 M-HISE (Figure 10 below) has been designed after the evaluation of the Tanzanian HMIS. The model suits information systems in developing countries well; however, the principles might be adapted to other settings. In order to construct such a model, the evaluator needed to understand the health care system, as well as how the information system was designed and developed (as explained above). This simplifies the whole process of model construction. Thereafter, depending on the evaluator's interest, variables of interest can be critically studied. For example, in the current study, after gaining a deeper understanding of the design and development of the HMIS, the evaluator embarked on evaluating the quantity of information collected, the quality of information collected, and how the data are utilised in practice M-HISE model. Other variables studied were the attitude of workers to the information system (user satisfaction in other studies) and workers' motivation (not in the model) as well as supervision of health care activities.

In developing this new model, insights were adopted from existing models and theories, such as DeLone and McLean's (1992) model, and Ballantine's (1996) model. Other existing models include those of Seddon et al. (1997) and Turunen (2001) (see above). In studying complex health care organisations, and health care information systems in particular, a methodology needs to be chosen for collecting and analysing the data: qualitative or quantitative or combining the two. For various reasons, I recommend the use of combined methods for data collection: qualitative and quantitative.

There are many similarities between the current model M-HISE in Figure 10 and the model of Ballantine et al. (1996), which is also based on information system theory: input corresponds to the technical development level, process to the development to users, and output to the delivery of business. The new Multi-dimensional model for health information system evaluation, as explained below, is based on the same principles and on the comments of Ballantine and associates on D & M's Model. The model is coherent with Donabedian's (1982) framework for assessing and monitoring quality of care.

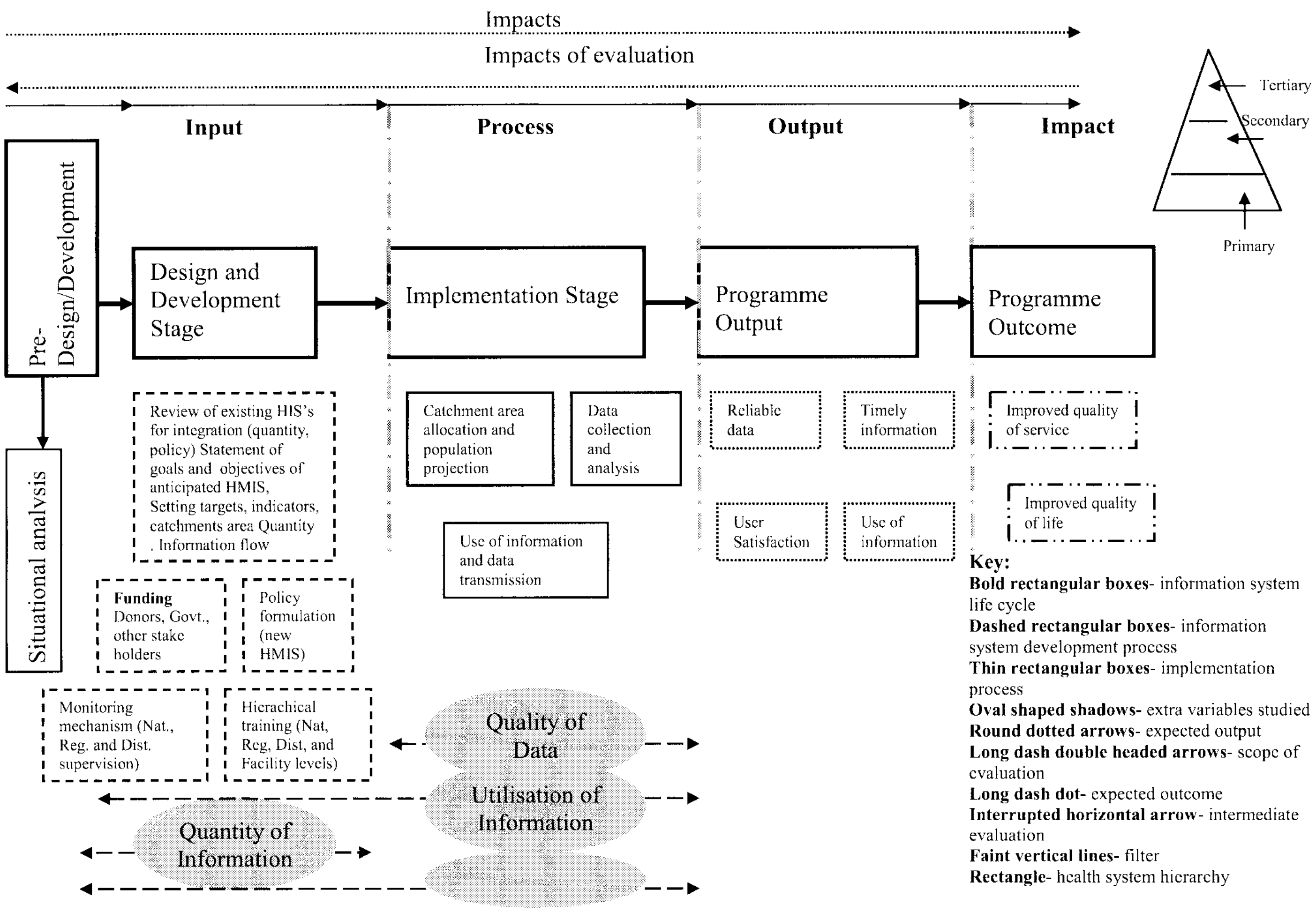
The model entails the development of the following parts: encompassing the life cycle of the model are five main components (Figure 10): (i) input (ii) process (iii) output (iv) outcome and the (v) impact. In the inputs there are two stages: firstly, the pre-design/pre-development stage, where situational analysis of the existing HMIS was done so as to establish if there is a need to replace the existing reporting system using the current MIS, and secondly, the design/development stage. The third stage is implementation (the only stage under the process component). The fourth stage is programme output (located in the output), the fifth and last stage is the programme outcome. Each stage of the M-HISE model (rectangular with thick borders) has several elements (displayed in rectangular boxes with dashed borders). These elements are activity variables taking place in every stage of the life cycle of the information system of a health care organisation.

Panel 12. Level description in multi-dimensional model for HMIS evaluation: M-HISE 2003

Components	Description
Inputs	are considered to be the health workers, equipment, time and resources that we put into a project, in order to initiate process and achieve outputs.
Process	is the implementation of the objectives of the project at particular level/s The processes associated with collection of health data are very important and involve training, data collection, supervision, data analyses and transmission as well as unit costs enquired, among others.
Outputs	are the information generated from the data, in order to achieve outcomes.
Outcomes	The use of information most important good quality, reliable, leads to better planning of health care interventions, improved quality of service, as well as proper management of resources.
Impacts	The above-mentioned outcomes are intended to lead to major measurable health impacts like, sustainable health interventions, reduction of diseases, longevity etc.

The outcomes mentioned in Panel 12 lead in the long term to major measurable health impacts such as sustainable health interventions, reduction of diseases, or longevity.

It is worth noting that the effectiveness of the M-HISE model is based on a clear, logical pathway of results, in which results at one level are expected to lead to results at the next level, leading to the achievement of the overall goal. Consequently, if there are gaps in the logic, the pathway will not lead to the required results (see in addition 2000).



Key:

Bold rectangular boxes- information system life cycle

Dashed rectangular boxes- information system development process

Thin rectangular boxes- implementation process

Oval shaped shadows- extra variables studied

Round dotted arrows- expected output

Long dash double headed arrows- scope of evaluation

Long dash dot- expected outcome

Interrupted horizontal arrow- intermediate evaluation

Faint vertical lines- filter

Rectangle- health system hierarchy

Figure 10 Multi-dimensional model for health information systems evaluation (M-HISE, 2003)

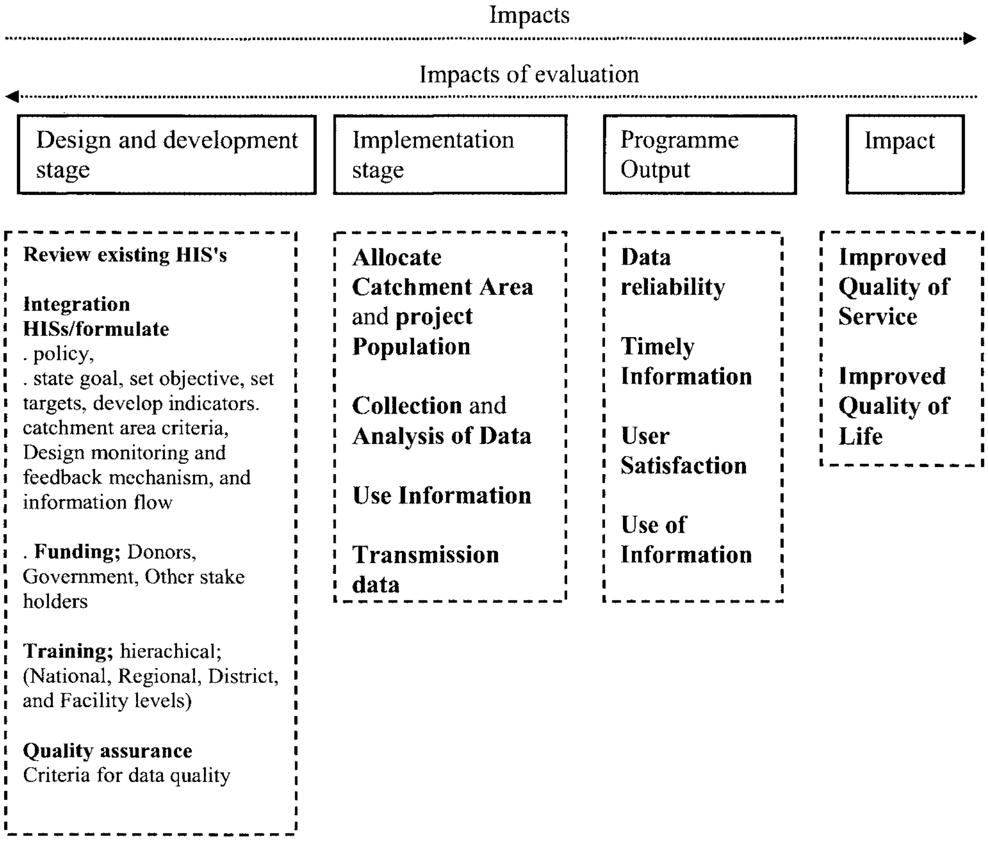


Figure 11 Summary of core model: Multi-dimensional model for Health Management Information Systems Evaluation: M-HISE 2003

studied ranged from the design and development of the HMIS, to the quality and quantity of information and data utilisation and supervision.

7.1.2 Method and Materials

There is a diversity of research methods or approaches in existence; however, any research method that a researcher chooses for studying a phenomenon of interest has its critics. The term *paradigm* is most frequently employed to describe such research communities and the conceptions of problem and methods they share (Sulchman 1986). The term paradigm has been used in different ways to mean models, patterns, or schemata. However, Masterman notes twenty-one different senses of the concept of paradigm by Kuhn and divides them into three categories: metaphysical paradigms, sociological paradigms and construct paradigms (Masterman 1970, p.61-66). Kuhn himself accepts Masterman's distinction of the three types of paradigms (Kuhn 1970, p.234). Thus, Kuhn's theory of science sees the progress of science as an open-ended cycle of `normal science´ - `anomalies' - `crisis´ - `revolution´ - `new normal science´ - `new crisis´.... (Chalmers 1994).

According to Gage, paradigms are not theories; they are rather ways of thinking or patterns for research that when carried out, can lead to development of theory (Gage 1963, p. 95). The most famous use of the term paradigm is that of Thomas Kuhn whose "*Structure of Scientific Revolution* (1970)" is a classic of contemporary history of science, which has become common parlance and the prevailing 'paradigm' of nearly all members of the social science community (Sulchman 1986).

The word paradigm has various meanings in that book, which the author only later systematised (Kuhn, 1974). The definition here is a sentence or a few sentences *describing* the essence of some part of the natural or social order (see also Redman 1993, p. 145). The term paradigm has been extensively debated (Kuhn 1970). Guba sees the term 'Paradigm' as having become a 'bucket word' to hold undue diversity; if we take it in a general sense of 'a basic set of beliefs that guide action' we are only a little further forward (Guba cited in Redman 1993). Different scholars using different paradigms fiercely criticise other approaches and defend their own. According to Redman (1993), economists use the term *paradigm* interchangeably with *Weltanschauung,* a sense in which Kuhn did not want it to be used, and have felt quite free to apply the concept rather indiscriminately, for example by commenting that paradigms are characteristic of pre-scientific stages as well as scientific stages of development. Redman (1993) cites Blaug who urged that the term paradigm should be "banished from economic literature unless surrounded by inverted commas". Nevertheless, a distinction exists between qualitative and quantitative research methods and the division of methods into categories conveniently suits the respective paradigms. Quantitative and qualitative methods are briefly discussed in the following sections.

Quantitative methods are generally associated with systematic measurements, experimental, and quasi-experimental methods, statistical analysis, and mathematical models. **Qualitative methods**, on the other hand, are associated with naturalistic observations, case studies, ethnography, and narrative reports. (Linn 1986). Wittrock (1986) cautions that it should be recognised that the boundaries between the methods sometimes become blurred. According to Stenhouse (1978), the two "cultures" appear to conflict more often than complement each other. Yet regardless of the divergence between the two methods, results relying on both methods contribute to scientific knowledge. Qualitative and quantitative methods are the most extensively debated. In relation to the distinction between quantitative and qualitative approaches to the practice of evaluation, Filstead asks whether, in order to be consistent, evaluators and practitioners must choose either one or the other? (Filstead 1979, see also Rossi et al. 1993, p. 254). Hemmersley (1992) distinguishes the two approaches as displayed in the following panel.

Panel 13 Quantitative and qualitative paradigms

Factor	Quantitative	Qualitative
Data is	quantitative	qualitative
Fieldwork in	artificial setting	natural setting
Empirical focus is on	behaviour	meaning
Natural science model is	accepted	rejected
Analysis proceeds by	deduction	induction
Theorising seeks	laws	patterns
Philosophy of	realism	idealism

Source: Hemmersley (1992)

In the real world, the paradigm issue arises when one approach is applied without much caution about how the result will be validated. Green explains this as follows: "Evaluators sense particular pressure to invoke such procedure because the context of paradigm evaluation continues to demand assurance of methodological quality and data integrity in evaluative work. This work can make no contribution to social policy and programme decision-making unless it is perceived as credible and trustworthy" (Green 1994, p. 537)

In the light of the polar differences in the two paradigms, the choice of paradigm for a particular piece of research rests on other issues, such as the availability of money and time, the objectives of the research and the type of data to be collected, as well as analysis of that data. Perhaps we should ask ourselves whether researchers choose methods because they belong to a certain paradigm or because of other factors such as those mentioned above? For example Muecke (cited in Juntunen 2001) suggests that a qualitative research approach is observed to provide a wider perspective than the quantitative approach to phenomena studied in developing countries.

For instance, Hemmersley (1992) comments: "for each of the seven elements of the divide between qualitative and quantitative methods (Panel 13 above), the characteristics of each paradigm element can always be identified in examples of research conducted under the alternative paradigm". In view of the paradigm debate, social work evaluators and practitioners have put various kinds of pragmatism forward as an alternative to paradigm thinking. Thus an evaluator whose work is well known within social work puts the case for a 'paradigm of choice': Patton asserts "a paradigm of choice rejects methodological orthodoxy in favour of methodological appropriateness as the primary criterion for judging methodological quality" (Patton 1990, pp. 38-39).

On the discussion of qualitative and quantitative, Shaw (1999) states: "Methodological pragmatism typically leads to a rejection of both epistemological and methodological 'purism', contentment with a 'good enough' methodology, and a pluralist approach to specific methods". However, Scriven (1997) complains about the 'philosophically besotted', and urges: "It is better to build on what might conceivably be sand... than not to build at all.... It is a waste of time to try to solve the problem of epistemology without getting on with the job" (Scriven 1997, pp. 478-479).

In conclusion, even though according to Kuhn (1970) the acquisition of a paradigm, and the more esoteric type of research a paradigm permits, are signs of maturity in the development of any given scientific field, it may be asked whether the argument about qualitative and quantitative paradigms is truly relevant, as only a small fraction of scholars fully belong to one paradigm, while most researchers are flexible on choosing methodology according to other factors.

7.1.3 Validity and reliability

Validity is fundamentally divided into two categories: internal and external. According to Rossi et al. (1993), internal validity is the basic minimum without which any experiment is un-interpretable: did the experiment's treatment in fact make any difference in this specific experimental instance? On the other hand, external validity asks the question of generalisability: to what population, settings, treatment, variables, and measurement variables can this effect be generalised.

In this particular study, in order to ensure internal validity, as explained in the methodology, the selection of respondents and the research assistant were given priority. The selection minimises bias resulting from differential selection. To ensure external validity or representativeness, pre-testing of the research instruments (questionnaires and question guide) was carried out, along with sampling of facilities. In other words, the validity and reliability of the current study adhered to recommendations by social science scholars such as Babbie (1995), Creswell (1994) and Rossi et al. (1993) and others cited elsewhere in this work.

The FGDs, for example, provided important insight into health workers' knowledge and attitudes towards the implementation of the HMIS, which include collection of the information and its analysis, interpretation and use, as well as transmission to other levels. The FGDs also provided valuable information on how to motivate facility workers on how to collect information and disseminating it to other levels judged as strong variable in validity of evaluation studies. For more on the validity and reliability of this study, see the chapters on evaluative research and methodology.

7.2 Health information system in Tanzania

In a broad perspective this section presents a discussion of the design and development of HMIS in Tanzania within the health care system. It encompasses policy for HMIS, setting targets for HMIS, developing minimum HMIS indicators, appropriate approach for catchments area allocation to health facilities, tools for data collection, pre-testing of the system, fund mobilisation for pre-testing and implementation. Other areas include supervision and feedback not limited to utilisation of information.

7.2.1 Health management information system design and development: an overview process for HMIS intervention in Tanzania

The decentralised organisation of health care management in Tanzania facilitated the development of an integrated health management information system. However, the existence of various vertical programmes funded by different donors requiring specific information rendered the previous information system fragmented. Nevertheless, the contribution of the donors, who funded the various programmes in different parts of the country, facilitated the mobilisation of all interested parties towards the development of an integrated HMIS. In addition, the mobilisation of various resources benefited from the social working culture and favourable environment of political stability that has existed ever since independence. Tanzanians among enjoy peace and tranquillity. Peace and stability are among the issues that are crucial for attracting donors and investment in various areas.

The experience of incorporating services under one roof has been realised in many settings. For example, unlike other countries, in Tanzania various health services (MCH, In-patient, Out-patient, Laboratory, Pharmaceuticals), are offered under one roof, thus making it easy to establish an integrated HMIS starting with a few districts and expanding to the whole nation within a short span of time. This was not the case in Ghana, according to Campbell (1997): "the process in Ghana was bottom-up and incremental in nature, but confronted with many differences in opinion amongst national level managers at almost every step. In addition, once the situation analysis and field-testing were completed, the system was expanded to only three of Ghana's ten regions." By contrast, Campbell further states: "in Nepal, one of the Asian countries which was never colonised, there was considerable more participation at the national level and the focus was on nationwide implementation. And system design took place with active inputs from all levels as well as all technical divisions and sections at the centre." The system implementation also took place with assertive top-down micro-planning and logistic support from the centre leading to an expeditious introduction nationwide (Campbell 1997).

7.2.2 Participatory approach in designing and developing the HMIS

The design and development of the Health Management Information System in Tanzania is not an exceptional case. As mentioned elsewhere, with some exceptions (e.g. HMIS policy), patterns and principles earmarked by the WHO, as well as experiences used in health management development elsewhere, were followed during its design and development. Despite the involvement of different stakeholders and the use of existing experience in community participation in the country, a fully participatory approach was not given due consideration in the development of the HMIS. Much involvement centred on the Ministry, regional and district levels with minimal involvement at the facility level: facility workers only became involved during the time of pre-testing and training, while at the community level there was almost no participation.

This kind of approach depicts a typical top-down approach, although the information flow and decisions-making follows a bottom-up approach. Besides, the health care system as a whole is considered to be decentralized or devolved, with autonomy given to local government to govern health care services at the level of the health centre and dispensary and at the level of the community. Heeks et al. (1999) in their paper on "Why information systems succeed or fail", cite other scholars (Neumann et al. and Raghupathi) as arguing that new information systems have powerful potential to improve the functioning of health care organisations, but themselves comment that this potential can only be realised if the health care information system can be successfully developed and implemented.

Campbell reports that in developing the HMIS in Ghana, participation took place in the form of Management Information System Working group (MISWG). This group was made up of people from different levels and different technical divisions within the MoH. "Once the objectives were clarified and the situation analysis was complete, efforts began to focus on the participatory design" (Campbell 1997). Similarly, though a top-down approach was use in Nepal compared to Ghana, participation was a key element in the design process: "virtually all directors and section chiefs were invited to every consensus-building forum" (Campbell 1997) According to Bjerknes et al. participatory design and an evolutionary approach to the development of information systems are characteristic of Europe and in particular Scandinavia. "The approach has a strong tradition of people centred and democratic technology development, which promotes action research and participatory design, including local adaptation and implementation of information systems." (Bjerknes et al. 1987 cf. Floyd et al. 1989, Braa et a. 1995, Korpela et al. 1994) The participatory approach and experiences from the Scandinavian context and elsewhere can be considered useful in facilitating appropriate design and development, implementation and use of information technology (IT) to support PHC not only in Africa but also in other developing countries and countries in transition.

Considerable experience has been gained in many countries in PHC information management, and some of it is relevant or at least provides inspiration even in quite different conditions (Ijadunola et al. 1998). Most of the rich existing literature on the participatory approach encourages wide-scale participation of stakeholders in planning and designing of MIS and HMIS in particular. For example, Braa (1995) emphasises that involvement of the community in the planning, managing, monitoring and evaluation of health services is a crucial to the PHC approach. The community will need appropriate information to determine health needs and to monitor health services. As such, the national health information system should facilitate the interaction between the community committees and the health services by involving them as active participants in developing the local information system. The system should address the needs of the community, as well as the needs of the health services. This approach even extends beyond the strictly medical. The adoption of participatory spatial planning (PSP) approaches has been partially supported by developments in participatory geographical information system (P-GIS), as seen in applications both in local resource management in developing countries of the South, and in community neighbourhood planning in the urban North (McCall 2002). The level of involvement varies widely along a continuum, with the variability depending on, but not limited to, various factors such as timeframe, available resources, what is to be done (objectives) and the level of knowledge (technical-know-how) among the would-be participants. In other words, these factors determine decisions on who should be involved and to what extent. This conforms to the notion that "the extent of the stake-holder's involvement will determine the sense of ownership" (Figueroa et al. 2002) and to the following suggestions given by Bossert (2002): "an important distinction is often made between the roles of participation, the degree of community participation, however, may be important", and "ownership develops when partners play a key role in formulating and implementation a project and understand the benefits of participation". Kraemer (1993, p.23) asserts that the recognition by each partner that he will be in better position to achieve his own goals by collaborating and helping his partners reach their respective goals is the best way to ensure partners are committed for the long haul". The factors mentioned above were taken into account during MTUHA development by formulating a working group involving higher officials from different sections in the MoH, and by the use of a 'trainer of trainers' approach during training of RHMT, DHMT and facility workers respectively.

Another area of involvement to be considered is that the information system should be congruent with the socio-economic and political setting of the country concerned. Other scholars have also recommended this. For example Ijadunola et al. caution that an improved information system must be based on the existing system and the socio-economic and cultural predisposition of the country in question (Ijadunola et al. 1998, cf. Bossert 2002). In spite of the importance of participation, the functioning of participation is considered cumbersome and, in general, the interface between the health sector providers and beneficiaries is weak (Bossert, 2002).

Like many other African countries, Tanzania has for much of its history been ruled by a single political party, the Tanganyika African Native Union (TANU). However, this has never undermined community participation and involvement, which has been the norm even under the single party policy. Multipartyism began in 1985, which initiated a truly democratic environment in the country. However, despite this strong quality possessed by Tanzania, as mentioned above, inadequate involvement of health facility workers and community has been noted. Similar observations are reported from Zambia: "...on paper, Zambia had a rather impressive structure of citizen participation from the facility to the district level, but these mechanisms had only been implemented to a limited degree and their variability and effectiveness was not clear" (Bossert 2002).

Partial or inadequate community involvement among other factors might have had an impact on the delivery and utilization of health services as well as the overall implementation of the HMIS. For example, there could be poor reporting to health facilities by traditional birth attendants and village health workers, malfunctioning of village heath committees, as well as lack of feedback to the community by facility health workers and non-use of information. Some of these weaknesses are well known to strategic managers, as the weaknesses were in existence even before the establishment of the HMIS. Thus strategic planners could have maximised the opportunity of community involvement to address community members, for example, on the importance of utilizing services according to catchment area.

It is well understood that involving people at all levels in all stages of planning enhances a sense of ownership and commitment, which promotes, but does not guarantee, sustainability. A sense of ownership and commitment should, however, come from "within", rather than outside the health system. Campbell (1997) emphasises the importance of involving all levels and all relevant departments in the design stage of health management information systems. He argues that this can provide ownership, commitment, and built-in understanding of how the system works. Participation during implementation helps to ensure that existing strong vertical programs do not maintain or create a separate, vertical HMIS (Campbell 1997). Successes following community involvement have been observed in Zambia: "the Health Centre Action Committees (HCACs) directly managed user fee revenues, and significant improvements in service quality and drug availability were attributed to community participation" (Daura & Mulikelela 1998).

7.2.3 Health Management Information System policy

As mentioned in the results, there is no policy for the HMIS in Tanzania. This is no surprise as the history of policy formulation in Africa and more generally in developing countries is similar. Like many African countries, among the first major issues given priority in the independent Tanzania was the provision of equitable health services, but in spite of the priority of health services, it was not until 1990 that the first Health Policy was put in place. The Policy aims to improve the health of all people, wherever they are, in urban and rural areas, by reducing morbidity and mortality and raising life expectancy. It considers that good health in the form of physical, mental and social well-being is a major resource for economic development (Ministry of Health 1990).

The major concern here is the time-span between independence in 1961 and the formulation of the first National Health Policy in 1990. An additional concern lies in the infrequency of review of the existing policy, which shows how decision-makers and policy-makers neglect policy issues. A good example is the case of the scourge of HIV/AIDS. Although known since the early 1980s, it was not until November 2001 that the National AIDS policy was commissioned (Ministry of Health 2001). Even then, the policy came into being only after pressure from local and international organs. For example, pressure for a policy on HIV/AIDS came from the participants in a workshop on HIV and malaria (Mkinga 2001): "...for an effective program in fighting the deadly disease, there is a great need for the government of Tanzania to formulate a national policy on HIV/AIDS." One participant lamented: "it is surprising ...some private companies have their own policies on HIV/AIDS while the Government does not have", and further commented that a policy would have assisted in the formulation of a sustainable program at the grassroots level (Mkinga 2001).

The policy deficiency in developing countries is widely recognised; few Third World countries have a national health and biomedical information programme or policy to support such programmes (Osibe 1989). The lack of policy on HMIS has also been noted by the WHO, which considers that lack of policy on information system limits the effectiveness of the HIS units in terms of the data systems they can support, as well as the analyses of data and dissemination and use of health information for decision-making (World Health Organisation, 2000). The organisation advises on formulation of information policy according to country requirements for information. In a study on health revolution in Africa, it is argued that it is difficult to condone failure to take action for children on the grounds that policy-makers are too pre-occupied and busy with finance and institutions (Bennett 1986). However, another reason might be the failure of a weak Ministry of Health to impinge on national policy in competition with ministries such as education, agriculture and defence. Bennett further reveals that even international finance has only recently recognized the importance of people, as opposed to mines and exports.

In an effort to contain the problem of policy on information systems, the WHO Department of Organisation of Health Services Delivery aims at strengthening the health information systems of countries worldwide, through collaboration with member states and enabling them to develop policy, strategies, tools and procedures to support health system management, health care delivery and decision-making and to develop efficient and effective health policies based on sound evidence (Lwanga 2000).

Lack of policy on HMIS is not without its effects; mushrooming of vertical information systems, non-reporting or poor reporting by some of public and private health facilities is a result of the weaknesses. Non-use of information by decision-makers and policy- makers could be the result of the non-existence of a guiding policy supported by appropriate regulations on information and its importance in decision and policy issues.

7.2.4 Funding Health Management Information Systems

Perhaps one of the major issues in development projects, not only within the health care system but also across other sectors, is how developing countries can design and develop projects without depending on funds from developed countries. The same applies to the development of integrated information systems and to seeing their long-term implementation. Huge amounts of money and considerable technical expertise are requirements for HMIS development. Owing to shortfalls in technical expertise, finance and technology in developing countries, the development of HMIS will continue to depend on external funding. Thus, in the development of the HMIS in Tanzania, the Ministry of Health, in collaboration with appropriate ministries, organized resources such as funds, materials and human resources from various foreign donors, and both government and local expertise. The Ministry of Health took a leading role in mobilising donors to contribute resources through meetings and workshops. Collaboration with stakeholders thus made it possible to put in place an integrated information system, which has worked until now. The importance of collaboration with donors and of their assistance is crystal clear. However, caution should be used when collaborating with donors and stakeholders, as some may dictate what should be included in the system so as to benefit their own needs.

The issue of financing health in developing countries is well addressed by the World Health Organisation: "one major constraint to HIS development, especially in the developing countries, is inadequate resource commitment to it, compared to other support functions of the Ministry of Health" (WHO 2000). Similarly, Gilson et al. (1994) state that in many developing countries, little funds are allocated for health budget from the national budget, and these funds amount to less than 4% of GDP. In particular, governments in sub-Saharan Africa are generally perceived to be under-resourced, and provide poor quality services (Atherton et al. 1999), with the budget still relying heavily on donor finance (Juntunen 2001).

Campbell also reports dependency on international organisations in developing MIS: "in developing the Ghanaian IS, financial and technical support was sought from United Nation Fund for Population Activities (UNFPA)" (Campbell 1997 cf. Braa 1995). Surprisingly, "it is fascinating to note that the activities in Ghana and Nepal were not originally envisaged in the existing government or external aid partner budgets" (Campbell 1997). Supplementary requests for funds from the UNFPA and UNDP were made in Ghana, whereas in Nepal, the initiative began with a modest line item allocation of $75,000 in a UNFPA project document for a 'target-setting workshop', and once the priorities had clearly been spelled out in the national HMIS strategy, a number of other donors joined the project.

As mentioned above, assistance for design and development of management information systems is not only provided in the form of funding, but also in the form of technical know-how. For example, in what is termed by Braa as the triangular model, South Africa, less developed countries of Africa and Europe make up the three sides of a triangle, so that the model gives the opportunity to the countries involved in developing the system to benefit from each other (Braa 1995). Another recent report also confirms this form of donor dependency: "with financial assistance from DANIDA and technical assistance from Euro Health Group and Management Science for Health (MSH), the Department of Health in Bhutan was able to embark on a review of the existing HIS and its enhancement" (World Health Organisation Southeast Asia Region Office 2002).

On the basis of these few examples discussed, it is obvious that Tanzanian dependence on donor support is no exceptional case. However, the crucial questions are: for how long should the dependency continue, and for how long will donors be willing to give the support? This remains an issue for the consideration of the governments of developing countries. Regardless of this deficiency, dependence on donor financial and technical capacities in respect of not only the design and development of HMIS but also their operation by governments of developing countries will continue to be necessary, at least until the governments of developing countries have managed to improve their economic performance.

7.2.5 Indicators, catchment areas and target population

Indicator development: Another crucial issue in HMIS is indicator development. The definition of indicators varies widely, depending on the perceived concept and the need for such indicators. However, despite the variation in definition, the major concern should be the development of indicators that meet the criteria for a good indicator. Heywood et al. (1994) advise that "a few indicators, based on reliable information, analysed and used to guide decisions, can provide much more meaningful management support than numerous data that are never analysed or used". Consequently, the WHO recommends the selection and definition of a manageable set of indicators called "essential health indicators". WHO emphasizes that essential health indicators should be chosen for national, provincial and district use, and the fundamental criteria should be usefulness for action, relevance for national and programme monitoring, and ease of generation and measurement. Other important criteria include validity, consistency, reliability, representativeness and sensitivity (cf. Rantanen et al. 2000, Kurpa 2001).

The advice provided by the World Health Organisation and by scholars seems not to have been fully taken into consideration in Tanzania. The indicators developed for the Tanzanian information system, as explained in the findings, are set uniformly throughout the country. As a result, in some areas it is almost impossible to attain them. For example, indicators for areas with high malaria prevalence should have a different target and threshold as to those with low prevalence. The data collected from these areas for about ten years since the information system was adopted should provide guidelines for setting better indicators. The same should be applied to other diseases. In the absence of actions to reset indicators, facility workers will continue to bear the burden and be subject to complaints for failures in performance.

Indicators describe the current state of the organisation, system or sector, monitor progress towards the preset objectives, provide evidence on achievement of the objectives, send signals of the need for special actions, and offer a basis for comparison of systems, countries and regions. Thus HMIS indicators should be very practical, service output or coverage indicators and should monitor services on a routine basis. Equally, it is important to develop a minimum set of indicators, which will be used to monitor, not only services provided, but also resources (human, financial and time), policy-making, implementation of MIS, infrastructure and other logistics. The indicators should be made very specific for each level of health care service delivery.

One strength of indicators in the HMIS under study is that the timeframe for specific indicators to be calculated at particular levels has been well set. Some indicators are calculated on a monthly basis, others on a quarterly or annually basis, but reports to the next level above are made every quarter. This is important to reduce the pressure of work on health facility workers. Only reports on indicators which need immediate action have to be submitted immediately. Heywood et al. (1994) ask "what specific decisions can be made at each level? And what specific information is necessary to make each of these decisions?" They then suggest that a few indicators based on reliable information, which are analysed and used to guide decisions, can provide much more meaningful management support than numerous data that are never analysed or used (Heywood et al. 1994). However indicators need to be specific to monitor services at a specific level.

Higher levels of management depend to a great extent on information collected by lower levels, which makes it difficult to set limits to the amount of information to be collected at primary level, irrespective of level indicators. Thus, utilizing the lower levels to collect and transmit information fulfils the whole concept of a system or information system. Therefore as long as certain information is needed at higher levels and has to be collected at lower levels, lower levels will be subject to collecting that particular kind of information. They will utilize what is within their jurisdiction and furnish the remainder to the higher levels above for the same purpose. This is one of the major reasons why the quantity of information to be collected at the primary level cannot be reduced.

Another important issue that needs to be considered at the time of indicator development is geographical location and feature, which to a great extent determine the variations in the pattern of disease. In this case the importance of utilizing a geographical information system is crucial: for example, in this study respondents across all levels have made it clear that some indicators set for their institution lack feasibility, because of failure to consider the distribution of disease in the country. The findings of a study by the Zanzibar Ministry of Health evaluating the use of an essential drug programme (EDP) support this: "... there was inadequate supply of Chloroquine in relation to malaria incidence and almost universal over-supply of oral re-hydration sachets" (Ministry of Health Zanzibar 1986). The weaknesses of indicator development has been highlighted by Kadt, who acknowledges that while some information is properly collected on a nation-wide basis, most HISs seem to have particular difficulty in accepting the fact that there are likely to be regional variations in the information needed, and hence in what should be collected and analysed (Kadt 1989).

In addition, for indicators to produce sound or meaningful information, facility workers should be trained in how to calculate various performance and service output indicators, and also in how to interpret the results and utilise the information generated. The issue of indicators will continue to be a challenge to information system designers; it has so far remained a substantial problem, not only for primary facility workers, but also across all levels. What actions are taken after signs provided by the indicators? What should be done concerning chronically unattainable indicators? Certainly, indicators need to be reviewed, and need to vary between seasons of the year as well as according to geographical location.

In conclusion, Kurpa (2001) offers the following advice: "there is a need not only to rationalise and select indicators but also to support the development of information and research systems to generate indicators". He then cautions that, however important they may be, programmes must not be indicator driven. Care must be taken to ensure that indicators serve to identify possible problem areas and contribute to decision-making, rather than becoming ends in themselves.

Catchment areas: Health programs set their goals on the basis of reaching a specified number of people (target population); specified indicators measure attainment of the target. It is therefore necessary to allocate to facilities specific catchment areas with a specified population, which comprise target groups. Allocating catchment areas to facilities not only helps the facility staff to know their service area, but also facilitates the calculation of target population, planning and designing interventions such as home visits and school health programs, and identifying potential resources within their areas. On the other hand, incorrect calculation of the target population has an adverse impact on all programmes. So both clear definition and accurate determination of the target population, and suitable allocation of catchment areas to a health facility are of great significance. Campbell stress on that "The target population is best calculated from the population living in the catchments area. (Campbell 1997)"

The allocation of target areas can be attained from different perspectives, in the early seventies Tanzania conducted a villagization process aimed at bringing people nearer together for easier social services provision. As part of this process, communities were allocated to service areas. In addition to villagization, the Universal Child Immunization (UCI) campaign further strengthened catchment areas as a basis for distributing services among health facilities. The allocated areas have since then been in use for all health programs with much success. Additionally, there are enumeration areas earmarked for population census and other surveys. The use of these existing structures is paramount to avoid duplication of work and increase cost-effectiveness.

Regardless of the Tanzanian experience, other lessons learned from other studies have their advantages: for example, the experience derived from Ghana and Nepal proves that there is no single way to demarcate a catchment area or calculate a target population. According to Heywood et al. (1994), "nationwide initiatives, efforts to maintain a community register as a basis for identifying catchments and target population, have almost universally failed"; rounded-off percentages were given for each target population and applied to a total district population, which was ascertained by the district health management team using whatever information source was available. They describe how, in a three-day workshop at the district, each health facility in-charge would determine the catchment population and target population for that particular year (Heywood et al. 1994). The advantage of this approach as explained by Campbell (1997) is that a sense of ownership is demonstrated by the DHMT and health facilities team leader, who "gained knowledge of the catchments and target population and recorded them immediately after training as well as four years after the baseline survey". However, this approach is not without disadvantages, including the necessity of repeating the three-day exercise every year in every district to incorporate population growth, migration and any new information about the catchment populations that becomes available (Campbell 1997). Furthermore, when denominators are estimated at the district level and below, they fail to conform with census-based or other often quoted sources of information at the national level, leading to discrepancies: during the development of the health management information system in Ghana, there arose a debate over which denominator should be used in monitoring (Campbell 1997).

The same source (Campbell 1997) gives the experience of Nepal, where a top-down approach was used to address the issue of target/catchment populations. Data from the latest (1991) census were projected forward using district-specific growth rates, which reflected an aggregate of birth, death and migration trends. Within each district, data were available at the lowest electorate unit (village). According to Campbell (1997), the advantages of this approach lay in its consistency throughout the nation; denominator data were standardized and, using an automated process, updated in each of the three years under study. The disadvantage of this approach was that district staffs and lower levels were not directly involved in making the estimates, giving rise to rumours of considerable error in the census-based enumeration.

The experience of Maharashtra State in India, which is reported to have produced some significant results, needs to be considered in other settings. Salunke et al. (2001) report that the introduction of the area approach, and the simultaneous implementation of family health folders in Nagpur district, has helped the district level managers to take the decision not to allot targets to primary health care services (PHCS). The approach was that no targets were given to PHC facilities or workers during 1995. Instead, from the available data and the availability of beneficiaries, the health workers themselves decided on their coverage strategy. The advantage of this new approach was the removal of what the authors called 'target anxiety' from the workers. In their experience, the health workers have now decided their own strategies for covering the beneficiaries from their area by providing them appropriate health care services. When the performance of the reporting PHC facility in Mansar in important family planning (FP) and Maternal and child health (MCH) indicators from April 1995 to September 1995 was compared to the performance for the corresponding period during 1994, it was encouraging to note that there was an average 12% improvement in performance for the important indicators. In reality this is feasible provided that facility workers are sufficiently motivated.

Target population: It is important to have health programmes which target different demographic age groups in populations in setting goals for performance coverage. For example, the expanded program on immunization (EPI) in Tanzania has the goal of immunizing 90% of all children before they reach the age of one year with Bacilli Calmette Guerin (BCG). In this case the target population is all children aged up to one year. Other targets exist for other services in adherence to international standards. In commenting on the importance of target populations, the Ministry of Health booklet on MTUHA Version 2.0 emphasises that "the target population is very crucial in determining the success for a set goal, for example of an immunization goal. It is therefore important to have a good estimate of the target population and group (number of children below one year of age). If the number of children below one year is under-estimated then the percent immunized will be over-estimated, and if the number of children below one year is over-estimated then the percent immunized will be under-estimated" (Ministry of Health 1998c).

Even with the utmost care in allocation of catchment areas, problems in coverage of the target population will be realised. The location of a population further away from the health facility intended to serve them than from a nearer facility not allocated to them will continue to be a challenge in the whole issue of catchment area and target population. In some cases, the quality of service provided by a facility will determine service use, regardless of catchment allocation. A good example derived from this study is from Mbalizi mission centre which serves a population from beyond its catchment area. Mbalizi Centre as a mission facility offers service of better quality than the public facilities that surround it. At times the Centre experiences shortage of stocks, especially in the maternal and child services, as the District Health Authority is responsible for providing certain supplies. The outcome of populations using different facilities has an effect on coverage, and so there is a need for the health facility workers to communicate among themselves on numbers of target group populations and locations of those who receive services outside their areas.

In concluding on catchment areas and target populations, it is possible to agree with what Campbell (1997) has suggested: "No single method appears to have all the advantages desired for identifying the catchments and target populations necessary to monitor program coverage. A top-down automated system as demonstrated in Nepal has many advantages. The participatory approach worked well in Ghana at the district level and below". However, he comments that both require updating annually, but this is more easily performed using the automated system, as in Nepal. He sums up that in any case, once a methodology is selected, the same methodology should be utilized consistently over time to enable valid trend analysis (Campbell 1997).

7.2.6 Tools for HMIS data collection

As revealed in the findings, the design of tools for data collection (client cards, various forms, tally sheets and registers) was no easy task and had to be approved by different authorities. Owing to the existence of different sections in the complex health care system, the development of a single tool, which could generate all the information needed by the health system, was unlikely. Departments such as maternal and child health care, in-patient, out-patient, laboratory and administration desire specific information and so tools for generating specific data essential for the particular department. Consequently, in order to put the current HMIS in place, most tools from the existing information system were redesigned. In the working group, old data collection tools were discussed, amendments made accordingly and approval obtained for their use for the current HMIS.

The process involved in the development and approval of the tools is crucial. Each tool used in a particular department has its own relevance; however, a consensus has to be reached on relevant data to be collected. Until agreement has been reached in a democratic way, no real integration of a Health Management Information System is attained. Norren et al. (1989) show the benefits of individual data collecting tools such as maternal cards and children monitoring cards in many developing countries. More than 70% of children in Tanzania have a child health card with information on date of birth, immunisation status, growth and diseases; this contains reliable data essential for PHC evaluation (Norren et al. 1989).

Kadt (1989) suggests that all HISs do, of course, manage data collection and processing. Ministries produce instructions about the proper way to fill in the data collection tools, which in turn eventually yield the national health service statistics. Yet instructions or manuals can be silent about essential issues. Kadt (1989) points out that the tools themselves have little or nothing to say about the *analytical* use of the information produced. The technical development of HIS tools has also been foreseen by the World Health Organisation: "in view of the common problems in information systems, which persist in most developing countries (excessive data recording, inappropriate recording, inadequate data analysis and reporting procedures and use of information) the organisation will assist member states in adopting or devising tools needed for the development of health information systems (HIS) particularly health management information systems (HMIS)" (World Health Organisation 2000).

7.2.7 Feedback mechanism

It has been stated in the protocol booklet on implementation of MTUHA (Ministry of Health 1993a) that in the Tanzanian HMIS, feedback to lower levels is not an obligation; as a result there is only partial feedback to lower levels. Primary health facilities are given direct feedback (verbal, face-to-face) immediately after each supervision. The supervisor writes his/her comments in the health facility book and signs it. This makes it easy during the next follow-up to monitor what has been accomplished and what has not. According to Shaw (1998), this system suits the western system in which individual objectives and staff appraisal are widely used, the underlying assumptions being that face-to-face feedback on performance is beneficial to a person, that individual performance can be identified within the organisation and specifically rewarded, and that monetary reward is a positive motivator. However, Seddon (1987) demonstrated that in many countries these assumptions are invalid, and such appraisal can be offensive to the individual and damaging to the organization.

Shaw (1998) speculates that face-to-face feedback is viewed in many cultures with deep mistrust, and is impossible in some cultures: a third party has to convey the message. My view is that face-to-face feedback is crucial, especially in a developing country where means of communication are limited. Therefore what is being practiced in Tanzania is relevant; however, additional feedback from higher levels including what is happening in other centres should be included. Health Research for Action (2000), in a review of MTUHA, observed that feedback to lower levels occurs infrequently, and when it occurs, tends not to be very useful or comes too late to be useful; in addition, MTUHA training focused mainly on the production of quality data rather than training in data analysis or interpretation, so that the information feedback was always in the form of compiled frequencies.

The HMIS has been designed in such a way that at each level, decisions are made independently of feedback on the basis of the information collected. In this way, delays are avoided and action is taken on matters that can be dealt with at the level concerned, resulting in the creation of a sense of empowerment, all-important features of the system. Another aspect that needs consideration when designing modes of feedback is the state of the communication network of the particular country (means of transportation, telephone network, internet and electronic mail). In many developing countries such as Tanzania, reliance on internet and electronic mail is not yet feasible as there is poor or no internet connectivity in most areas, the telephone network is unreliable or unavailable in many places, and the road network is poor. Consequently reliance on feedback from the higher level could cause unreasonable delays. Direct feedback during supervisory visits is a more reasonable approach, but not without its own disadvantages: for example, one major constraint is limitations on comparability among facilities within the same district. Such comparisons could act as reinforcing factors (benchmarking).

Despite non-reliance on feedback, it might be important for the higher levels to send at least half-yearly feedback to lower levels. In the case of Tanzania, the MoH is scheduled to send a report to the RHMT annually or whenever requested by the latter. In the current study, some facility workers expressed expectations of receiving feedback from reports sent to higher levels, of being supervised and of receiving supplies of materials requested. In other words, feedback is a necessity even if it is not an obligation. In the recent Southeast Asia Region consultation meeting, documented elsewhere in this thesis, one of the major issues at least in every country represented was the establishment of a simple reporting and feedback system with active involvement of the community as well as strengthening information dissemination (World Health Organisation Southeast Asia Region Office 2002). However, despite the importance of feedback, written feedback should be sent from the district level only when necessary. The amount of time and other logistics needed to produce such a report may sometimes exceed the contents of the feedback. Instead of sending unnecessary feedback to all facilities, which will sometimes not be acted upon, specific follow up when necessary to a specific facility could be of value.

7.2.8 Type of data collected

The study has established that the type of data collected is greatly pre-determined by the need for such data in existing programmes or facilities (organizational settings). The type of data collected has also been found to determine the tools for data collection. This was taken into account in the design phase: the Tanzanian working group scrutinized the fragmented information systems of all the existing programmes, and integrated them into a more standardised report format. As mentioned in the findings, clients' cards, tally sheets and registers existed and instructions are clearly given on how the data generated from them are to be collated into reports and submitted to the next level above. The foregoing findings conform to the experience noted by Campbell (1997) in Ghana: "the decision to design an integrated reporting format prior to the review of data collection and recording instruments involved considerable discussion among senior department of health services staff and technical advisors from USAID, GTZ, WHO, Rädda Barnen and UNFPA". An added advantage was the opportunity for both parties to clarify the most appropriate indicators (Campbell 1997). Furthermore, as each item of data required for reporting was identified, it became clear precisely what kind of client cards, registers or tally sheets would be necessary as a source of that information.

Similarly, Norren et al. (1989) discuss that the HIS can provide data on health service utilisation patterns and certain intermediate variables such as immunisation coverage, drug distribution, specific diseases treated and proportion of deliveries in maternity. As explained above, in Bhutan the information flow and frequency depends on the nature of services and appropriate interventions require for each programme component (World Health Organisation Southeast Asia Region Office 2002), which also conforms to the findings of the current study.

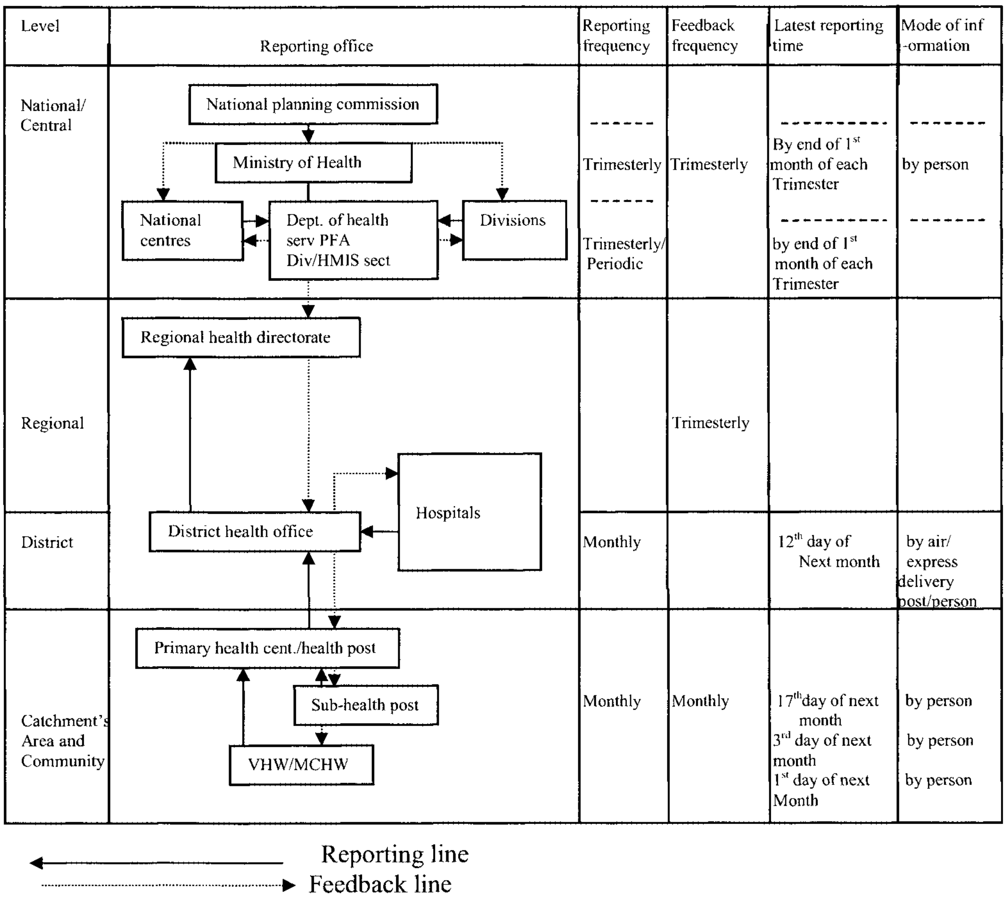
On the crucial but justifiable variation in timing of information submission, which is a finding of this study, reports from sections are compiled by section heads (MCH, In-patient etc.) and submitted to the Medical Recorder for compilation before submission to the In-charge who checks them for consistency and makes the final submission to the district level. However, other respondents, after receiving information from the sections, compile the report and send it directly to the district. Consequently there is a variation of time in submitting reports as elicited by the study findings. The size of workload in a section and the number of workers in that particular section also determine the speed with which the report can be made available to the next recipient. The awareness of facility workers of the variation, and of the consequences of delayed report submission, shows their understanding of the role that information plays in their day-to-day work and the work of others at other levels. Given this finding, it seems reasonable to comment that delays that occur in this particular information system result from other factors than lack of awareness of the usefulness of the information collected.

7.2.9 Information flow

The flow of information has been designed to follow the hierarchical order of the health system, from the periphery to the centre. In other words, information flows from primary health facilities, to the district, then to the region and finally to the Ministry of Health. The current information system has despite the delays largely ensured the availability of information from lower levels at the next level. Some reasons for the existing delays lie in the manual mode of information transmission. It was anticipated that equipping the regions and districts with computers would enhance information flow. However, for various reasons this has yet to be realized and will probably take time. Computers distributed to districts have not been installed with the appropriate programme, and in addition, the lapse of time since the so-called 'MTUHA processors' received their computer training means that retraining will be mandatory, as there has been no opportunity to use their skills. There is also some reluctance to use computers among DHMT members: use of computer is still perceived as the job of a secretary, a lower cadre! (Personal observation)

Mbananga and Sekokotla. (2002), in a study in South Africa on the Mpumalanga province information system, makes a similar observation: "information is collected at clinics and hospitals and sent to the district level, where collation, analysis and aggregation of data occur. From this point, aggregated data are sent to the provincial level, where further aggregation is implemented, after which it is submitted to the national level". Mbananga and associate acknowledges that there is still much work to be done in order to achieve complete health computing as a solution to problems such as access to data and improving the flow of information (Mbananga & Sekokotla 2002). In the MTUHA review carried out by HERA, ill-timed decisions are related to delay of information at a particular level: "In order for decisions to be made at the right time, it is important that the processed and interpreted data/information be available ahead of time. In the present information system, this is not generally happening, resulting in decisions that are late or unlinked to the resource and management need to implement the decision. Thus the decision may not be making any useful contribution to improving health" (Health Research for Action 2000).

HMIS information flow follows a well-described pattern, with explanations of the frequency and type of information needed according to level. The means by which information should flow remain primitive (manual aggregation), especially at the primary level but almost equally at the district level. The same has been well described by Campbell (1997) in his study on Ghana and Nepal. A schematic information flow for the latter can be seen in the chart below. Design of information flow patterns is only important if they are supported by other means that will ensure that the information is made available to the next level above or below (Campbell 1997). Such means include computers, equipped with an appropriate electronic mailing system, to ease the analysis and transmission. Other weaknesses of the HMI Unit in the Ministry of Health include the inability of the current staff of the unit to manipulate the computer programme (for various reasons a consultant is required), and the non-functioning of the software shared by the Unit for some of the tasks expected in the regions. There was no in-built mechanism for sharing information among the districts, regions and even the Ministry of Health departments. For example, the training department in the ministry has its own database, which stores information collected from training institutions. The pattern of information flow described by Robert and Roscoe (1992), is relevant and supportive to the discussion above concerning information flow in Nepal, and is shown in Figure 12 below.



Level	Reporting office	Reporting frequency	Feedback frequency	Latest reporting time	Mode of inf -ormation
National/ Central	National planning commission Ministry of Health National centres Dept. of health serv PFA Div/HMIS sect Divisions	------ Trimesterly ------ Trimesterly/ Periodic	Trimesterly	---------- By end of 1st month of each Trimester ---------- by end of 1st month of each Trimester	------- by person -------
Regional	Regional health directorate		Trimesterly		
District	District health office Hospitals	Monthly		12th day of Next month	by air/ express delivery post/person
Catchment's Area and Community	Primary health cent./health post Sub-health post VHW/MCHW	Monthly	Monthly	17thday of next month 3rd day of next month 1st day of next Month	by person by person by person

Figure 12. Information flow from catchment area and community through district and region to relevant agencies at the national level in Nepal. Source: Campbell 1997.

Information flow is shown by Robert and Roscoe (1992) as a system flow chart or an amplified document flow chart and includes files and processing steps. This is a useful, if not absolutely necessary, method because it pictorially describes a system and shows how all the processing steps, control, personnel or developments, decisions, documents, reports, files and databases, and processing equipment interrelate to form a system. This is almost impossible to do in a narrative description.

7.3 Quantity of data collected

It has been documented by many authors that the amount of information required by the IS or collected by PHC workers is enormous, and consumes most of their time filling in forms, while at the same time little of it is utilized for decision-making. While this comment can be justified, the problem of the quantity of information is not restricted to the amount of information collected by primary facility workers and minimum indicators set. The point is that if that particular information is not collected at that particular level in that particular moment, then it becomes almost impossible to get that information when needed. From my own perspective and experience, in addition to the amount of information collected, the problem of information quantity also lies in the tools used to collect and aggregate the data as well as incentives to motivate facility workers. In other words, despite large quantities of information to be collected, given appropriate incentives in terms of working environment, equipment, proper and adequate training as well as adequate supportive supervision on the HMIS in question, facility workers could still collect more information with less stress.

In support of the foregoing argument, as the findings of this study show, in spite of the huge amount of information demanded and collected by the information system, facility workers still maintained a positive attitude towards the information system. The ability of the system to collect all necessary data was rated at 78%, which signifies that workers are satisfied with the system. The majority of workers also perceived the IS to be important for their day-to-day operations. Primary facility workers' main concerns are proper training in data collection, improved and more supportive supervision, a good working environment and motivating incentives (salary and proper allowances e.g. for outreach programmes). Facility workers expressed concern for patients who spend much time (waiting time) in facilities during the whole process of data collection. It is however, surprising that patient waiting time has never been given due consideration by information system designers and developers or discussed in the many studies on HMIS, for example those of Health Research for Action (2000) and Kalowela (2001). Perhaps this is one important area where more research needs to be considered.

According to Mordue (2001) on quantity of information, the strategic UK policy group commented "it was impossible to think of any information relevant at one level that was not required in more detail at the lower level." In information systems development, this means that while systems must be acquired and implemented at the local level to meet local needs, this must take place within an overall strategic framework devised at the national level. In this case reducing the amount of information to be collected at a particular level, especially primary level remains a problem.

The current study has revealed that there is significant variation among and within professional groups concerning the time taken to collect client information, and also the satisfaction with the time used for this process. There are differences in information requirements in different sections of a facility as well as among clients themselves.

The HMIS in Tanzania, although designed as an action-led information system, gives the appearance of a data-led information system. Behind this approach is the notion that all data is inherently useful and that it is worthwhile to pinpoint even those problems that nothing can be done about (Sandiford et al. 1992). By contrast, the action-led approach attempts in the first instance to relate information need to intervention or potential intervention, with a focus on how the information generated will influence decisions and on the significance of these decisions for the health of the target population. The issue of too much information will remain unresolved, because more data are always being recommended for inclusion; for example, it has been observed that health information systems are not designed to provide timely and relevant data for emergency preparedness and vulnerability reduction (World Health Organisation 2002). Therefore, it is essential to transform the system in order to help provide data required for management of natural disasters and emergencies. This means that the amount of information required by the system is ever on the increase.

7.4 Quality of data collected

Quality of data means having correct and meaningful data which can be utilised for managerial, policy-making and planning issues or any other purpose. Consequently, set criteria are needed to measure quality; as mentioned elsewhere, in Tanzania the working group established the following criteria for quality data: completeness, correctness and cleanness of data collected. The quality of HMIS data as well as quality of care depends primarily on the attitudes of health workers. The attitudes of workers can be determined by observing the health workers performing their day-to-day activities or by assessing the various tools used to collect the data. The health worker also needs to have the skills necessary for correct use of the tools: training should cover the proper recording of data on cards and in registers, the correct plotting of weights on a growth chart, correct completion of registers, calculating indicators, completing all the required reports, planning immunisation schedules and carrying out outreach visits to villages within the facility's catchment area.

Similarly, in a broader perspective quality of care depends on a number of organisational issues such as the culture of the organisation, its environment and organisational behaviour. Issues such as the organisation of waiting time in clinics to be as short as possible, respecting planned appointments and ensuring availability of drugs (keeping good stock records, ordering in time) are equally important. The issue of quality is broadly discussed below according to the objectives and findings of the study.

7.4.1 Completeness of information

Information in the current HMIS is not completed as required, as was revealed by the checklist used in this study to assess different tools used to collect and compile the data, and reported in the results. At the primary health care level, some tabular and other variables are unreported or reported late. This results from the fact that some data from the community (TBAs, VHWs and the village health committees) are not received in time or not received completely. Since there is some reluctance by facility workers to conduct outreach to villages, such incompleteness of data will continue to affect the whole issue of data quality. Despite the supervisions conducted, incompleteness of data has continually persisted for all months revisited. The result is delay or lack of compilation of reports at the level next above, raising doubts as to the validity and reliability of the data collected and non-use of the reports by different users.

Most of the data collected is on output indicators while the remainder is thinly spread over input, effect and process indicators. As such data are essential for health care planning at different levels, ensuring validity of data is crucial. For example, if certain data are not calculated and submitted to the level next above, it is improbable that that level will compile its report or subsequently submit it. This chain of effect impacts all levels up to the apex. Erratic recording of numbers of patients or cases contributes to unrealistic plans for services, as the total number of people receiving services is in doubt. Erratic recording and reporting of prescriptions also causes uncertainty over the drugs that should be ordered and the epidemiological pattern of diseases.

A further effect of data incompleteness is the delay in producing the 'MTUHA abstract', or annual MTUHA report. The report by the Ministry of Health admits that the HMIS reporting rate is low, and this is confirmed by the review report by HERA; there have always been delays in completing the health abstract, which is an analysis and compilation of HMIS data received from lower levels (Ministry of Health 1999; Health Research for Action 2000). Even the health abstract that is produced has incomplete sections, showing that data was not available at the time of production. This weakness has been discussed by HERA: the HMIS unit was unable to contribute effectively, the information product and process of the central level showed substantial weaknesses, the statistical abstract consisted only of tables without interpretation and was based on data that were two years old by the time of publication, and relatively few copies of the report were circulated (Health Research for Action 2000).

In a similar situation, quality of health management information in the South African province of Mpumalanga has been described as inaccurate, incomplete and inadequate in informing managers on all the decisions they needed to make (Mbananga & Sekokotla 2000). From the same study, one information manager mentioned that at times the information received was neither complete nor accurate, and commented: "Quality and accuracy, I don't think we have mastered them as yet." Another information manager remarked that "if there are no measures of keeping up with the information that is left out then that information will remain inaccurate" (Mbananga & Sekokotla 2000). These statements demonstrate that information quality remains a major problem. If appropriate measures could be put in place, information quality could improve, leading ultimately to increased utility.

Most of the HMIS indicators that are not completed are those that require feedback from the DHMT, such as broken equipment, reports from TBAs and village health committees and annual leave schedules for facility staff. The issue of incompleteness of information could be curbed if the supervising team laid more emphasis on the issue, and also themselves met the requirement of providing feedback on requests submitted by facility heads. Lack of responsiveness to such requests demoralises workers to complete tables which they know will not make any difference anyway. This conforms with the statement in the MTUHA booklet and the recommendation by Husein et al. that supervisors should also check the quality of collected data as well as its recording so as to ensure that there are no errors in compilation or calculation (Ministry of Health 1998c, Husein et al. 1993).

7.4.2 Correctness of data and information

Another major discrepancy in quality of data collected is correctness. The study found that errors are often made in recording medicines prescribed, both in terms of dosage and in relation to the diagnosis. The issue of dosage lies beyond the scope of this study, as clinicians and others who prescribe drugs in dispensaries (Medical Attendants and Maternal and Child Health Aides) might not be competent. This could improve the quality of service, user satisfaction and rate of use, leading ultimately to improved quality of life and longevity. Other inaccuracies occur in the recording of items used or remaining in stock, and reporting of symptoms instead of proper diagnosis. Prescription drugs can have serious side-effects and interact with other medications (Blendon et al. 2003).

These disparities in quality noted above have variable impacts, ranging from the quality of care provided and timely delivery of services to clients to planning and organisational issues. The Ministry of Health considers that quality can be attained by "doing the right things right in the right way at the right time"; If this is the case, why does the problem of data quality persist in the presence of supervision from all levels? Does the reason lie in lack of training of some facility workers, or low standards of education among them, or negative attitudes towards the MIS? Although some weaknesses have been noted in the area of training and supervision, these questions cannot be completely answered by this study.

Mbananga & Sekokotla (2002) note that information is a factor that reduces uncertainty, and its value is realised when it is used to make a decision. Timely and accurate data and information is vital to the effective management of a health system or programme. Furthermore, information is important because it enables responses to changing needs, it is necessary for quality management, it helps to produce consistent quality of service, it ensures the timely delivery of services, it assists in the provision of effective services, which in turn improves health care consumer satisfaction, and it is vital to making informed decisions.

In a broader perspective, it has been observed that a nation's competitiveness depends on the capacity of its industry to innovate and improve, and information plays an important role in these processes of innovation and improvement (Porter 1991). According to Black and Marchand (1982), competitiveness partly depends on the capacity of organisations to manage and utilise available information. If, as proposed by Pitt et al. (1994b), the measure of information system success should include service quality, then given all the disparities of information quality revealed by this study, the success of the HMIS in Tanzania is in question. Then it is valid to conclude that plans made from poor information are not feasible.

The incompleteness and incorrectness of data is contrary to the primary aim for quality, as stated in the 1993 HMIS proposal and in conformity with other systems elsewhere. "...All these efforts were envisaged as the provision of complete and correct data/information, which is vital for informed decisions by managers in all levels of care for the benefit of their population" (Mbananga & Sekokotla 2002).

7.4.3 Cleanness of information

As mentioned in the results, most of the various data collection tolls in almost all primary facilities involved in this study were not clean. Various corrections, erasures and examples of poor quality writing make the whole data recording exercise chaotic. Once again it is surprising that in spite of routine supervisions conducted by DHMT members, the poor quality of data persists ever since the inception of the HMIS about ten years ago. District supervisors should give their comments on what took place during the supervision. Amazingly, in all facilities visited no written comments were given in places where supervisors were supposed to write their comments on various common discrepancies observed during supervision. In most cases, the supervisors only signed that they have visited, which implies that it is customary to give verbal advice or corrective instruction rather than documenting this advice in written form.

From the disparity explained above, it might be concluded that the system of conducting supervision is weak; however both DHMT but RHMT members carry out supervision visits to facilities in order to validate reports from the districts. How long this weakness will continue to exist or be accepted is a complex issue for this study, but it seems that those entrusted with assuring the quality of data are currently satisfied with the situation as well as those who collect the data. Another contributing factor to data of poor quality might be the increased staff turnover and the arrival of health workers who are not trained to use HMIS. For some time now, there has been reluctance to deal with HMIS in the medical and paramedical (training) institutions. The HERA review reported this and recommended inclusion of MTUHA in the curricula of training institutions in the country (Health and Research for Action 2000)

In fact, the lack of emphasis on correct performance by both supervisors and facility workers makes the collected data questionable not only to themselves but also to those who wish to use the data for planning, research or other health and health developmental issues.

The discussion above is well founded, as a similar situation has been reported to prevail among managers in Mpumalanga district in South Africa (Mbananga & Sekokotla 2002). The writers observed that the continued existence, after all these years of information systems development, of problems with regard to the quality of information signifies a structural problem. Another fact recognized in this report is that information management is based on individuals rather than units. The issue of training is cited as the solution to this problem.

In conclusion, improving the information quality though not directly will improve the organisation, financing and management of the health sector and inform social policy and health policy regarding affordable treatment for the poor through review of the cost-sharing system.

7.4.4 Professional training

Professional training among facility workers determines their ability to conceptualise the undertaking of HMIS among other tasks within ones jurisdiction. On the whole, professional training is critical for understanding new issues, such as the understanding of MTUHA training, implementation, supervision and utilization of data collected not to mention evaluation and the ability to make rational decisions. Thus the lack of basic professional training combined by means of a low level of basic education has an impact on the overall implementation of MTUHA and should never be ignored. Health service professional training in Tanzania, as in many other developing countries, is considered poor and lags behind in curriculum review, provision of qualified, competent and motivated instructors, and contemporary knowledge as a basis for training. This is further worsened by low budget allocations to training institutions. Despite the recommendations of other studies, the failure to include MTUHA in the curriculum of paramedical and medical training institutions remains a major limitation. This problem also appears with other reforms that are taking place.

7.4.5 Impact of supervision and information feedback mechanism

Supervision is one of the roles of a leader, and for staff motivation and smooth running of health facility operations, effective and supportive supervision is essential. Effective supervision can create an appropriate working environment and sound working culture, which in turn is conducive to the attainment of organisational objectives and goals. But before carrying out meaningful supervision, many questions need to be answered concerning the frequency of supervision of lower levels, items for inclusion in the supervision checklist, choice of supervisors, and appropriate length of supervision. Other issues are the amount of money available or amount to be allocated for supervision, and considerations of the expectations of those to be supervised. Campbell suggests that in principle, given time and financial resources limitations, selecting a few issues and or health facilities for supervision and feedback based on HMIS information collected is necessary (Campbell 1997). Campbell's recommendation would be more cost-effective approach than providing supervision on all topics to all facilities. In this regard HMIS should provide an alarm system for selective supervision (Keller 1991). Similarly, the World Health Organisation has since 1981 placed more emphasis on the important role of information systems when supervision is difficult: "peripheral health workers often find themselves working on their own for a long period of time, rarely supervised or supported by higher level, yet wanting to provide comprehensive quality services within the minimum resources they have at hand. To manage these resources more effectively, workers need to develop the ability to analyse the information available to them, both informally from their knowledge of the community and formally from the routine health management information system" (WHO 1981c).

The MoH has designed a standard supervision schedule including a format (check-list) for supervision (MoH 1999) and advises on adoption and adjustment of the format by the RHMT and DHMT according to local needs as stated elsewhere in section 6.9. This initiative by the Ministry is very positive, but it is doubtful whether managers at district level take these recommendations into serious consideration. Instead, it is likely that the tools are simply used as they are, even when they suit some areas less well. The supervision frequency and schedule differs from one level to the other; however, DHMT and facility workers have to be supervised by the next level above at least once every quarter, while the region must be supervised by the national level at least twice a year. Ad hoc or emergency supervision can be carried out in cases of change or divergence from performance and ethical standards in health care delivery. Similarly, supervision can be carried out when a serious problem or disaster occurs, and the performance of certain indicators at the lower level can trigger the planning of a supervisory visit.

The designed supervision plan provides supervisors with a wide range of managerial powers to deals with issues prevailing in their areas. However, the discrepancy between the Ministry's plan and actual practice at regional and district level is not coherent with the advice. For example, the capability of members of the DHMT to supervise remains questionable. Had supervision been effectively carried out, either the inconsistencies in quality of data found in most primary health facilities could not have existed or improvements would have been observed time after time. This has been well documented by (Husein et al. 1993) and explained on discussion on quality of data above. The frequency of supervision advised by the Ministry of Health agrees with the findings from Ghana that the tradition of supervision from the national level had been replaced by structured supervisory scheme from the region and the districts. The national level was to take on less supervisory responsibility and strengthen their roles in policy and planning (Campbell 1997). This shows that there was flexibility on how levels should conduct their supervision.

Health Management Information Systems are designed to take a bottom-up approach, it would theoretically be feasible for the RHMT/DHMTs to develop their own instruments for supervision; however, limitations may arise in developing a standard uniform checklist to meet the national requirement (21 RHMTs and over 114 DHMTs exist in Tanzania). In order to prevent such inconsistency, and on the basis of accrued experience, lower level problems and needs should provide a guide for the national level, together with members of RHMTs, to develop a standard action-led supervision checklist. The checklist should provide scope for adjustment by the regions/districts according to their needs.

As for the issue of who should conduct the supervision, this is another area of concern which has been highlighted. Some of the RHMT and DHMT members were rendered less effective as supervisors by their lack of training in MTUHA, and the fact that their knowledge was based purely on on-the-job training and self-development by reviewing literature. In order to carry out effective supportive supervision, a combination of trained and untrained supervisors is needed. In this approach, consultation on issues encountered and dialogue on solutions can be carried on, which at the same time may enhance the relationship between supervisors and supervised, provided that effective communication is employed. Kadt (1989) insists that little of use to district or provincial health authorities can be expected of monitoring operations relevant to local conditions in the absence of people able to understand what information is most important, and how it might best be used. Furthermore, in his view improvement in monitoring procedures will not come about by *fiat*, but will require training of all those involved from lowest level upwards (Kadt 1989).

The Ministry of Health has foreseen the existence of disparities among the members of the DHMT: "Within the management team, members have different background knowledge, skills and experiences. The ministry advices that this will always dictate the limit, which the supervisor can go in supervising subordinates" (Ministry of Health 1999). The fact that the supervisions conducted seem not to improve the implementation of MTUHA shows that supervision stands as one of the main problems identified by this study. Examples have already been quoted of the failure of supervisory visits to deal with the lack of complete, correct, and clean data collection tools; another might be the failure to adjust unattainable indicators despite the recommendations of facility workers.

Given the shortfalls outlined above, what is the relevance of supervision? Is it cost-effective to do continuous supervision while basic problems such as ensuring cleanness, correctness and completeness of data collection tools remain persistently unsolved? Is there a need to reschedule the mode of supervision? Such are the issues needing consideration. The money earmarked for supervision could also be invested in other plans, such as developing workers' capabilities by conducting training and follow-up training. Strengthening workers' capabilities would motivate them and improve their attitude, and hence improve performance in delivery of care as well as in implementing HMIS.

Nevertheless, in the researcher's view, improving supervisors' skills so as to improve the quality of supervisions would be a reasonable exercise. The HERA review cautions that when performance monitoring is not prioritised, there is low accountability and waste of resources of all kinds (human, material, financial etc.). Both negative and positive examples are given: on the negative side, in one district where money was not being used for supervision and monitoring, reporting rates were of the order of only 10% of facilities; on the positive side, where supervision was being done in a supportive way on a regular basis, the reporting rate was above 90% (Health Research for Action 2000). This example alone justifies the continuation of the practice of supervisions, but with improvements. By contrast, Campbell (1997) reports the opposite finding, that in both Ghana and Nepal, the relationship between HMIS and supervision was weak. He raises the concern that 'at district level, it remains unclear what exactly led to the improvements noted in the baseline survey and follow-up studies'.

Another major weakness in relation to HMIS and supervisors can be answered in part by the current study: MoH, RHMT and DHMT members receive a substantial amount of money as supervision allowance. Such allowances are not made available to facility workers during their village visits. Facility workers are responsible for making at least one supervision a month to every village within their catchment area and are irregularly paid or not paid at all. Unlike workers at higher levels, who are motivated by supervision allowances, facility workers are de-motivated to carry out village visits as scheduled. The issue of allowances created heated debate during all the FGDs. Facility workers even questioned the rationality of provision of supervision allowances to DHMT members who use convenient means of transport to bring them to the facility, and not to facility workers who walk sometimes up to 14 kilometres there and back.

To facilitate their outreach visits, facility workers, in particular MCH aides and health assistants, carry with them vaccine carriers filled with vaccines, various forms and registers, MCH cards, family planning pills and also drugs (folic acid, vitamin A capsules, ferrous sulphate and oral rehydration salt (ORS) sachets). They also carry steam sterilisers filled with vaccination needles and syringes. However, the situation differs between public and private facilities. In the case of private institutions, transport and meals are provided, while nothing is made available in the public health care setting.

Similar constraints have been discussed in a qualitative study of family planning (welfare) services at the primary health centre level in the state of Karnataka, a state in Southern India. In that particular study, Bhatia reports "junior health assistants (known as ANMs) are not provided with any transport facility from the department to carry out tasks assigned to them. Non-provision of transport was found to be a source of great dissatisfaction and disappointment for almost all the workers who participated in the focus group discussion" (Bhatia 2000). Almost all of them indicated that they had to cover several scattered villages, and in the absence of adequate transport facilities, a large amount of time is spent on travel, which to a considerable extent affects their work routine. In addition, a serious problem encountered by the ANMs is that of carrying registers, equipments, drugs and other materials to the villages covered by them, particularly for immunisation purposes. This problem is acutely felt during outreach immunisation programme for which the ANM's has to carry several items such as vaccines carrier bin, cooker, registers, drugs, and contraceptive devices.

Facility workers in Tanzania ironically pointed out that MTUHA is considered as an example of the 'bottom-up' approach, but that when it comes to allowances, the opposite becomes the norm! A major concern is that how can this be a reality within the same system. These disincentives were blamed for malpractices such as data forgery, or completing forms with unreal data without visiting villages, which were mentioned to be in use. Equal consideration should be given to all staff; which would mean that village visits conducted by health facility workers should be considered as the equal of supervisory visits carried out by MoH, RHMT and DHMT members, and thus allowances should be allocated for such visits. It is stated in the national supervision guidelines of the Ministry of Health (1999) that the supervisors will prepare allowances; however it is not clearly stated to which level of facility workers the allowances should apply.

Another problem among supervisors is the disparity in knowledge about the frequency of supervision that management teams should conduct and the furthest distances they should travel. The disparity shows the inadequacy of the management teams' approach to the whole issue of supervision. How is it possible to conduct repeated supervisions time without knowing the distances to health facilities or even the required frequency of supervisions? The question could be raised of whether supervisions are being carried out for personal gain or for the greater good of the health services. The whole supervision plan is thus shown to be erratic. My personal observation at the time of collecting data for this study and during another visit to Tanzania in year 2002 was that the DHMT has in practice no consistent time schedule for starting supervisory visits. Among issues that delay the actual time for departure on visits are personal reasons, organisational (district council) bureaucracy in obtaining fuel (local purchasing order system), supervisors' multiple or competing responsibilities (medical officers also have to carry out all the post mortems within their catchment area leading to cancellations of visits), and mechanical vehicle problems. There is a need to improve the transport system, as well as to revise the whole supervision plan so as to organise effective and efficient supervision resulting in better performances by both supervisors and supervised.

In order to perform effective supervision, Campbell (1997) commented that HMIS has the potential to guide supervision, feedback, and in-service training: 'Supervision must provide constructive criticism as well as praises and encouragement. HMIS can be a source of praise, as well as a tool to identify and provide most effective strategies for improving service coverage." However Campbell sympathises that, supervision was one of the last sustainable and consistent management functions observed. A viable complement to supervision was the institutionalisation of a structured mechanism to ensure feedback through face-to-face exchange among peers and between managers and service providers at different levels in the system. Alter and Hage (1993) gives an alternatively, suggestion that work can only be shaped, improved, and adjusted by learning processes that return information about the results of the inter-organisational work back into network system as participants engage in decision-making.

Clearly, if the HMIS is to succeed in providing sound information to be utilised by policy-makers and decision-makers, then the source from which the information originates (health facility workers) needs to be strengthened in terms of continuous training and motivation by providing supportive supervision. Supervisors should work harmoniously with facility workers, as they are the ones whose efforts will lead to realistic achievements in the health services. They are the first contacts with the community; neglect of their needs and concerns has an impact on the health of the entire society. Harsh language should be avoided, as was expressed during the FGDs, in favour of supervisors assisting workers to learn from their mistakes and make improvements thereafter. Bhatia's (2000) study also shows imperfect relationships among supervisors: from the FGDs, it is reported that although supervisory styles vary considerably, almost all ANMs perceived supervisors as mainly interested in seeing that the targets assigned to them are achieved. Bhatia (2000) reports that some of the ANMs mentioned that their supervisors showed no concern over their problems or the quality of services. In particular, the following comments were made: "the supervisor does not bother about how I carry out my activities so long as I complete my targets... "have you done this? I am not interested about knowing how you do this, whom you do contact and the like. What I want are results. Just deliver them and I will never bother you. If you don't... then I am not responsible for what happens" " (Bhatia 2000). Although positive attitudes towards supervisors exist, the cases of harsh language and disconcert shown by supervisors are not limited to Tanzania.

7.4.6 Training in health management information systems

Basic professional training, on-the job training or distance learning and self-learning (continuing education) are among the methods for imparting new knowledge and skills to facility workers. In recognition that the HMIS was a new approach for routine data collection being introduced to facility workers in the health care organization, the Ministry of Health officials and appointed consultants conducted training in HMIS knowledge and skills for RHMTs. The intention was good: as mentioned above, the training was organised in a 'trainer of trainers' (ToT) approach, in the sense that workers in the higher levels (RHMT) trained those in the next level below (DHMT), who in turn subsequently conducted training for the level below them (primary health care facility workers). In this way, the training was carried out more quickly than could have been the case if central trainers had had to conduct all the training.

Despite the training of trainers system for HMIS training, the training component remains one of the most serious issues in establishing and implementing HMIS. This study has pointed to six major reasons that rendered the HMIS training in Tanzania less effective.

First and foremost, not all staff were trained, and more than half (53%) of the primary facility workers had not received formal HMIS training. Similarly, one-third of DHMT and 40% of RHMT members had received no formal training. As for PHC facilities, each health centre was represented by at least three staff, while two came from each dispensary. The aim was that trained primary facility workers would train the remaining staff in their respective facilities. However, this proved a failure; the anticipated training received some objections (revealed during FGD). Training received from colleagues who had attended formal training was perceived to be imperfect. Those who had been trained were unable effectively to utilize the training to train others, especially at the primary facility level. The principal investigator of this study was among those who received training during the pilot study as well as before the countrywide intervention. Thus my personal experience contributes to this section, and in my view the content of the training was too great for the time allotted. The course was so comprehensive with so many indicators to be calculated that it was difficult to grasp the new knowledge within the seven days of training, let alone make use of it later to train co-workers.

Secondly, the training integrated diverse professional groups who had different levels of both basic education and professional training. In primary facilities, staffs of all cadres were brought together. Although for good reasons it was impossible to avoid the use of this method, the staff members' levels of knowledge and perhaps also ability to take in new knowledge or learn new skills varied significantly. Allowing more time for slow learners could be considered.

Thirdly, the seven-day duration of facility worker training was too short to impart new knowledge and skills to serve such a complex system as HMIS. Knowledge of individual roles and responsibilities within HMIS remains low at all levels. Interview respondents and group discussion participants considered the training to be ineffective because they were unable to utilize the knowledge acquired to train co-workers. Their opinion was that a reasonable amount of time needs to be set aside for such training, as it involves the introduction of new skills and knowledge. So there should have been at least 10 days of training to enable the system to be properly understood and utilised to train co-workers.

Fourth, lack of enthusiasm among some facility workers to participate in on-the-job training was another limitation. A substantial allowance was provided to those who participated in the formal training and to those who acted as facilitators. But when it was time for health facility workers to train the remaining facility workers, no allowances were budgeted for, which turned out to be a major reason for the reluctance to participate. This is a typical example of the effects of top-down management when it comes to financial issues.

Fifth, the majority of health workers were trained in HMIS around 1994; since then no follow-up training has been conducted, and new workers do not receive training in their respective medical training institutions.

Sixth, the impact of HIV/AIDS on the health sector has caused many premature deaths mainly due to AIDS across all formal and informal sectors, including among health workers. The capacity of not only the health sector but also the entire government machinery has been affected, creating a gap in the overall performance. The increasing burden on government machinery can only be addressed by employing strenuous measures to train and retrain workers, combined naturally with the adoption of HIV/AIDS preventive measures. The absolute impact of the HIV/AIDS scourge on both training and implementation of MTUHA and on the overall health care system was revealed in the interviews and FGDs. Some facility workers have already died, and some are still suffering from the disease and consequently incapacitated.

In addition to the above situation, which has affected the smooth undertaking of MTUHA, there is a huge turnover of staff who have completed their academic training and been employed by the health sector. The majority of them have had no training in MTUHA, which exacerbates the already marginalized information system.

Such findings have been discussed in other sources. The impact of HIV/AIDS, for example, is well documented in the Global AIDS epidemic update report of June 2000: "...at the same time, HIV-related illness and premature death among health care workers themselves will continue to create costs of another kind for the health sector... as in other sectors of the economy, rising rates of HIV infection in health care workers will increase rates of absenteeism, reduce productivity, and lead to higher levels of spending for treatment, death benefits, additional staff recruitment and training of new health personnel" (UNAIDS 2000). Previous studies have also pointed out that many training programmes for health professionals and auxiliaries pay little attention to such necessary areas as planning, management and use of information for health care support (Smith et al. 1987, Wilson et al. 1987). It has been recommended that health workers need to be taught not only how to fill in forms correctly, but also how the information provided can improve the work in which they are engaged (Kadt 1989). Findings of other studies in conformity with the current findings include those of Health Research for Action (2000): "with the exception of medical record officers in Kilimanjaro Christian Medical Centre (KCMC), MTUHA is not included in pre-service training curriculum of other paramedical and medical institutions"; and Atherton et al. (1999): "DHMT members that have undergone training through the district planning and management-training courses by the zone training centres perform in general better than untrained DHMTs".

Contrasting findings can also be cited. In Kenya, the majority of health workers were trained in HMIS around 1990, and that training was offered during their basic professional training (Mordue 2001). It would be of value for the Tanzanian MoH to adopt the practice practiced by Kenya, fellow members of the East African Union. In Ghana and Nepal, trainers conducted the training within facilities (Campbell 1997). Anticipating that many in-charge posts would be vacant at various times of the year, all service delivery staffs were trained in the use of the integrated reporting format. This had the added benefit of actively involving every health worker in the HMIS. Similarly, Atherton et al. report that in some of the districts of Mbeya region, a team of district trainers undertook the provision of intensive in-service training on service quality improvement (Atherton et al. 1991). The advantages of such training over the more traditional forms (residential) lie in its relevance (conducted at the workplace, based on direct observation of performance), avoidance of disruption to services, promotion of team-working, reinforcement of staff-supervisor and staff-community relationships, and relative cheapness and cost-effectiveness.

In my view, one most important aspect of HMIS training is the allocation of sufficient time. Whether facility workers are trained in their respective centres or brought together, and whether different cadres are mixed together or not, might be issues that affect training to a lesser extent; neither is formal or informal training the main issue. The important point is time: inculcating new ideas, unfamiliar to most facility workers, such as indicator calculations or target populations needs sufficient time for both training and practice. Provision of allowances for primary health worker trainers is of equal significance.

These comments mentioned in the foregoing section agree with the findings of Shaw (1998) on professional development without formal training: she reports that managers often comment that most of their important training experiences have occurred while actually at work: learning from senior officers, colleagues, and subordinates, learning their job thoroughly, learning from taking on new responsibilities, or from short-term projects, learning from professional activities and even learning from voluntary or social work outside the hospital. However, work-based training as referred to by Shaw has both merits and demerits; on the merits side, learning is fully integrated with work but can be accredited, while as for demerits, learning requires extra time for learners and the full commitment of employers. Such a system is difficult to implement in developing countries, and in Tanzania in particular. Workers who are already de-motivated by the working environment and the lack of incentives would be reluctant to spend any extra time on non-income learning.

Given the shortage of workers trained in HMIS at various levels of the health care organisation, the call for more training and retraining should not be ignored. In addition, another important consideration for the MoH is whether to incorporate HMIS in the curriculum of its medical institutions. Perhaps this would provide more capable workers who would collect valid data and information of good quality and also utilise the information effectively.

7.4.7 Attitudes towards HMIS

In this particular study, it has been found that there is a variation of attitudes towards the HMIS. However, the majority of primary health facility workers had a positive attitude. Accordingly, among the total of 60 primary facility respondents, 78% shared the perception that the management information system in place is collecting all the information required and 12% of them had the perception that the system fails to collect all the information required or collects more than required respectively. This implies that there are differences in information requirement among facility workers, and the information system design may be based more on the requirements of those Public Health Nurses and General Nurses (93% and 91%) who within cadre reported that the MIS collects all information required compared with Laboratory Attendants and Clinicians (70% and 65% respectively) who felt that the system collects less than required. Information system designers should consider how to develop the ability of HMIS to collect information equally in all sections of the health care system. Nothing from the literature reviewed related directly to this particular area. Although Campbell (1997) comments on the ability to use information for different activities at different levels, he makes no comment on the ability of the HMIS to collect such information. Kaplan et al. (1994) cautions that in developing, implementing, and evaluating such systems, the stakes are high.

7.4.8 Incentives for motivation

"Evidence abounds that people are motivated by intrinsic rewards, yet this is often not taken into account especially when health care organisations, jobs, and information and control systems are designed" (Vuori 2001). As mentioned above, there are several reasons why health workers performance may be below average. In addition to low salaries, poor working environments (poor buildings), inadequate equipment and supplies, and lack of staff are among the many factors beyond the scope of this dissertation that contribute to poor health worker performance. Similar observations have been reported by Atherton et al. (1999). Health services in sub-Saharan Africa are under-resourced and provide a poor quality of service. In Tanzania in particular, there are few workers at the rural dispensaries, and the majority are not motivated to carry out their roles effectively. Poorly motivated workers will fail to perform their duties as required: one of the crucial issues concerns mistreatment of patients or clients by harsh language, as well as inappropriate behaviour towards them. This phenomenon has been well documented in business settings. According to Ulrich (1997 cf. Donner & Wheeler 2001), in an environmental change, the focus on human resource practice can have a major positive impact on business results. There is no doubt that this also applies to healthcare. As Flanagan (1997, p. 188) puts it, "if you want staff in an organisation to treat customers well then 'the organisation' must treat the staff well."

Despite the multiple problems that contribute to low performance among health facility workers, I will concentrate here on salary and allowances (e.g. village visit allowances as brought out in the focus group discussions) as incentives to motivate workers towards performing their roles. The findings of this study show that of the total of 60 primary facility worker respondents, the great majority (90%) were dissatisfied with their monthly salary (Figure 8). The small percentage who claimed to be satisfied came mostly from the mission health facilities. Health worker salaries in

Tanzania are low and bear no relation to those earned by teachers, policemen or soldiers. There is no formal body to monitor workers' promotion and incentives. In spite of such problems, health facility workers continue to give care to patients. However, it should be put in mind that poor salary has a direct impact on the overall worker performance and hence the quality of care provided to customers. Burgess (2003) describes his own experiences working in Africa: "I was extremely impressed by nurses who were providing amazing care in clinic and hospital settings in spite of everything. They did their jobs... with salaries that were tiny and months and months late... with little in the way of medications and medical supplies... with incredible overcrowding."

A similar hardship work situation is reported in the state of Karnataka in India, where most of the Medical Officers (MOs) appear to be frustrated and dissatisfied with their service conditions (Bhatia 2000). Many of them take the view that in view of the abysmal conditions prevailing in the PHCs, they are unable to deliver the services in an effective and efficient manner. Reasons mentioned for poor coverage and quality of services included corruption, favouritism, lack of concern for people, irregular policies by the government, and lack of administrative procedures. "There is corruption at all levels in our department. We have to bribe at each and every stage, from clerk to higher officers, to get salary and other claims passed. We are not supplied with stationary and registers and have to purchase them locally from our pockets and the expenditure incurred by us is never reimbursed" (Bhatia 2000). Similar dreadful situations can be found in many developing countries. But the end sufferer in this chain of bribery or corruption is clearly the client or patient who needs the services and who is also the poor citizen who reliably pays taxes so as to get services, according to the law of the land.

Worker performance is determined by various incentives to motivate them to perform their day-to-day activities. Regardless of whatever training is given, without incentives to motivate them, workers will not utilise their knowledge and skills as effectively as they could have with rewarding incentives. In the educational context, for example, "individuals are rewarded to do those things that are rewarded, behaviour that is rewarded is the behaviour to which faculty will devote their time and effort" (e.g. Lucas 1994). There are many common causes of poor performance, including unclear job expectations, lack of performance feedback, poor motivation, weak management or leadership, deficient knowledge and skills, and inadequate facilities, equipment or supplies. According to Lucas (1994), these causes can further be grouped into the following three categories:

- Lack of knowledge/skills
- Lack of motivation

- Lack of adequate policies/management systems

These categories provide guidance in the selection of appropriate interventions for particular healthcare facilities and enable actors to focus on action, or in other words move quickly from the identification of performance gaps and the causes of those gaps to concrete changes (cf. Maternal and Neonatal Health 2003).

Lucas (1994) summarises that "because motivation is so complex, and there is great variability among people, a leader must discover what is particularly important to each faculty member" and goes on to point out that discovering what is important to an individual need not take a lot of time, but discussion at meetings would yield information about the unique factors that motivate each person.

In Tanzania, in order to augment their income, facility workers especially in rural areas utilize part of the official working hours to attend to private issues such as their farms. Workers in the urban settings work in private facilities during normal working hours. Similar observations have been reported in World Health Reports concerning many health care systems: "... some if not most physicians work simultaneously for the public sector and in private practice" (WHO 2000). This means the public sector ends up subsidizing unofficial private practice, and in addition, many governments fail to prevent a "black market" in health, where widespread corruption, bribery, "moonlighting" and other illegal practices flourish. These black markets, which are themselves caused by malfunctioning health systems and the low incomes of health workers, further undermine those health systems (WHO 2000).

Other unfortunate ways of compensating for poor salary and lack of motivation incentives include engaging in forms of corruption such as the prevalent sale of medical drugs and illegal charging for supposedly free services. Currently cost-sharing has been introduced in the country, making it possible for health workers to avoid issuing receipts and pocket the money. The foregoing observations conform to findings by Gilson et al. (1994), in their study conducted in Morogoro region in Tanzania, who observed that one of the major weaknesses of the poorly perceived government health facilities was the shortage of drugs due to their being sold illegally.

Facility workers regard themselves as cogs in the health care machine, as although they perform their work, they are not given due consideration in terms of incentives, which shows that they have lost the sense of feeling part of the system. So in my view, workers performing similar roles to those performed by workers at a higher level should be considered equally for incentives. Facility workers are obliged to visit villages within their service area at least once in every month. The service area of a health centre can encompass up to seven villages, with the distance from facility to village ranging from one to fourteen kilometres. As mentioned earlier, regardless of the weather, facility workers walk all the way carrying with them certain items to facilitate their work. This state of affairs was brought up in every focus group discussion and aroused heated debate among facility workers themselves as to who was responsible: donors, MoH or the DHMT.

Other authors report similar findings/feelings: Kanungo (1994) observed that in India 'the satisfaction of afflictive needs take precedence over satisfaction derived from job objectives'. In addition, Bennett (1986), after asking whether the pace of progress towards Health for All could be accelerated in any dynamic way, and what the constraints or issues were, mentions as one of twelve constraints that incentives to work were often inadequate and little consideration was given to the need for rethinking incentives. He questions how a health worker can survive on a salary that can buy food for only few days of every month. This is the situation which obtains in many countries in Africa. According to Rossi et al. (1982), many programmes fail to be implemented and executed according to their original design because project staff members may not have the motivation to carry out their set tasks as designed.

7.4.9 Health information utilization

"To have appropriate information is one key element for the improvement of planning capacity" (Kadt 1989).

According to findings of this study, there is variable data/information utilization at varying percentages among professional groups at different levels. As seen in Table 14, most information is used mainly for planning daily activities. Supplementary information from the FGDs showed utilisation for ordering drugs, planning health education, referral of patients, organising outreach and follow-up of cases in case of disease outbreak among other purposes. In general, this shows that there are no long term plans worked out from the information generated. The low data utilisation is due to the fact that not only facility workers but workers across all levels have little or no knowledge of data analysis and interpretation or information use. The District Health Management Team in this study produced no initiatives to use the information collected by the system; rather, in their comprehensive district health plans, the goals and objectives set were unrelated to information obtained from MTUHA.

Other studies have shown similar findings. For example, the study by Kalowela (2001) in Mbinga district in Tanzania revealed variable rates of information use, which was higher among nurses (75%) as compared with clinicians and other staffs. Similar reasons for low use of data were put forward, such as low knowledge of data analysis and variable knowledge of data utilization among facility workers. Abrantes (1987), in a study done in Portugal, shows that among health workers knowledge of data analysis and of how to use health information for decision-making is deficient. Similarly, Maimela et al. (1989) in Botswana made the observation that health workers did not know how to use the data they collect. Other studies with similar results include that of Osibogun et al. (1996) in Nigeria, Siaga et al. (1993) in Zambia, and the WHO (1999) in Fiji. All these studies reveal that peripheral health workers lack the knowledge and skills that would permit them to gather the best possible data, analyse and interpret this data and make use of it for provision of services. In most cases, workers have failed to resolve the problems of insufficient use of information for local decision-making and inadequacy of information in respect of quality, quantity and timeliness (Smith et al. 1989).

In spite of these various experiences, according to the action-led view of health information systems, poor data quality is seen as a consequence, not a cause (Sandiford et al. 1992). Thus health managers reported in Mpumalanga province that they used health management information to make simple programme-oriented decisions, despite its poor quality (Mbananga & Sekokotla 2002). On level of knowledge in the use of information, I concur with my colleague Kalowela that level of knowledge may not be the only factor influencing the use of information at the facility level. Kalowela gives an example from the FGDs conducted in his study of how health workers gave priority to the issue of high MTUHA workload due to shortage of health facility staff as the major reason for non-use of data. On the basis of this study, these results might to a great extent have been compelled by the kind of training given to facility workers. Furthermore, it is not unexpected that there were a number of respondents who said that they did not know what they should do with the information, especially in such cases where multiple factors such as low education among respondents, lack of basic professional training, ineffective or no training in HMIS or data analysis and utilization, and lack of proper and effective supervision come into play.

Other factors discussed by HERA which contributed to non-use of information generated from the HMIS included poor preparation of data for use, a weak sense of owning the data, lack of support from higher levels, poor capacity for decision-making, and in addition insufficient analysis skills and training, and lack of initiative to use information (Health Research for Action 2000). It was expected that after the implementation (in 1982) of the Structural Adjustment Program under pressure from the World Bank and the IMF, reducing the size of the government workforce (retrenchment) would lead to the employment of only well-trained staff. On the contrary, more poorly-trained and less educated staff are being employed. The formation of hospital boards will further exacerbate the poor quality of employees in the health care system. As is customary, such members will promote employment of their relatives regardless of academic attainment, which will lead to poor quality service.

Utilisation of information for decision-making: This study has shown that different workers in different sections of health facilities as well as at different levels use the information generated to make various decisions. These decisions are mainly on an everyday basis rather than for long-term planning. Usually, under the current system, very little evidence can be found to establish how the information is used, because many decisions of facility workers are made spontaneously without documentation, and some are based more on intuition than data. Ordering of medicines and vaccines, and planning of maternal and child health activities and annual leaves are the most basic areas in which the information is utilised. In general, the utilisation of information is far from what it should be. This is due to lack of knowledge about decision-making from information collected (evidence-based decision-making). This phenomenon is prevalent not only among primary facility workers but also workers at other levels all the way to the apex.

Decision-making is the hallmark of an information system. When decisions are made on the basis of the information collected by the entire system, then the information system can be described as successful. Lack of empowerment to make decisions is one of the major issues which deter health facility workers in Tanzania from using the information to make such decisions. Facility workers are limited to decisions on minor issues and short-term plans. Most of the decisions are made centrally and imposed on them for implementation. This is documented by Mbananga and Sekokotla: "the hierarchical nature of decision-making strips lower managers of authority and power to make decisions. And external forces and disruptions cause problems in following plans and decisions that have already been made" (Mbananga & Sekokotla 2002). However, Heywood et al. (1994) advised that the kind of decision taken at each level need to be determined. In general, these can be broken down into technical decisions, operational decisions and strategic decisions. Most managers make a mixture of decisions, determined by position and local circumstances (Heywood et al. 1994). Given the accuracy of this observation, it is acceptable to find facility workers as well as those at other levels having limitations on what they can decide and what not. On the other hand, Heywood et al. (1994) go on to advise that the HMIS should be shaped in order to facilitate decisions at each level.

The value of information depends on factors such as relevance, comprehensiveness, accuracy, clarity, simplicity and timeliness (Hayward & Broadway 1995). These factors influence the utility of information in decision-making and have a direct bearing on an organisation's ability to respond to market needs. All meaningful business activities or decisions are based upon information in one form or another. Health systems managers should realise that by using information resources to encourage effective decision-making, they can design the future of health services (Du Toit & De Villiers 1996). Equally, a 'culture of information' exists when information is seen as a critical input to public health decision-making at all levels, when quality data is demanded, and when data is transformed into useful information and used by decision-makers (Partners for Health Reform*plus* 2003).

Another limitation to decision making lies on the ability to interpret the data in to information that will lead in to decisions. Since facility workers as well as those in the levels above lack this potential skill, very few decisions base from the data generated. Thus there is a need to train health workers and professionals on information interpretation indicators attainment and use the meaning for decision-making. Heywood et al. (1994) put it that the task of the action-led manager is to select only those indicators which have 'punch' in the sense that they relate directly to objectives and will lead to action on the basis of informed decision. In the absence of ability to utilise information for decision making, most third world countries do not base their health plans on concrete data, which alone can allow health delivery facilities distribution and programmes to be based on rather than political power to elite interest (Osibe, 1989).

7.5 Developing a framework for evaluation of health management information systems

The model developed here has been called a Multidimensional model for Health Care Information System Evaluation 2003 M-HISE. The notion of a multi-dimensional model is rational and consistent with the design of the model: combining system theory (seen as life-cycle in the model), the stages of the HMIS, and the hierarchical levels of the health care system.

Donabedian (1978) was the first to divide health quality measurement into three categories: *structure*, *process* and *outcome* (cf. Turunen 2003). He postulated that the quality of health care can be regarded as a function of the *structure* of the health care, the *process* that is carried out in the health care to produce the service and the *outcome* of the health care (Donabedian 1982). These categories can also be recognised in information systems. The *structure* denotes the attribute of the setting in which the care is provided, and consists of material resources such as facilities, equipment and money. The *process* can be regarded as the actions that make up the patient's health care (Donabedian 1988), and Donabedian suggests that the *process* criteria of quality assessment could be classified as either technical or interpersonal (Donabedian 1978). *Outcome* is defined as changes in the patient's health status resulting from health care services (Donabedian, 1978), and as such also measures the end result of the process. *Outcome* is also usually considered as the result of one or more consequences (Närhi 2001).

However, Lohr (1988) characterised outcomes of medical care with five D's: death, disability, disease, discomfort and dissatisfaction. He recognises outcome as the end result of medical care. However, Lohr's definition contains a number of weaknesses which have been identified (see Närhi 2001).

A summary of how Donabedian's dimensions of quality apply to the M-HISE model can be followed in Panel 12. The framework aimed at assessing quality of care (cf. Donabedian 1980, Turunen 2003), and is widely known, used and well referred (Turunen 2003). As mentioned above, in the framework, quality assessment is built on the concept of three elements: structure, process and outcome. These features are clearly displayed in the new model, but with an additional dimension of output before outcome. There is coherence in meaning of the dimensions between the new model and Donabedian's framework; however, each is consistent with the particular field of study *(information system / quality of care)* Panel 12, which compare the explanations in Turunen 2003).

The development of a simple framework for evaluating HMIS is almost impossible: the complexity of the health care organisations where the implementation of such systems lies determines the simplicity or complexity of the system. This is in line with the suggestions made by Ballantine et al. (1996), although Wilson (2000) recommends that monitoring and evaluation (M&E) models must be as simple as possible. In my view, most of the models which look simple attempt to evaluate only one section of the system but not the whole.

Wilson (2000) argues that "the more complex an M&E system, the more likely it is to fail". However, he fails to specify what he means by simple or complex with reference to models. The issue of complexity or simplicity is subjective and involves many factors. A model can fail at any stage, be it simple or complex. According to Ballantine et al. (1996) failure at one level should not be concluded to imply total failure of the system.

Finally, as can be seen in M-HISE, at the base there are four variables in oval-shaped shadows. These four, together with the assessment of the health care system as well as *design and development of the HMIS* were the specific objectives of the case study, which led to the development of the current model. The *quantity* of data collected by the information system was obtained by assessing the types of information collected at every department in a health facility, and the *quality* of data collected, was assessed in terms of completeness, correctness, and cleanness of data, workers' attitudes towards the information system *(user satisfaction in the model)*, motivation by salary and workers' training in HMIS, and how the data are utilised, all of which were studied.

Ballantine (1996) suggested that these variables should be considered neither dependent nor independent, nor as causally related, because they might work at more than one level e.g. in the use of information and in monitoring. Some of the elements that were studied cannot be located in the model, as they might be indirect or difficult to incorporate: this has been observed in other studies too, and Cronk (2000) cautions that "in reality it may not always be possible to observe each dimension in strict absence of its interaction with the other dimensions". However, as Ballantine et al. (1996) put it, "to be useful, a model must be both complete and parsimonious". Perhaps this is what determines the simplicity or complexity of a model.

Campbell's (1997) analysis of the design, implementation and utilisation of health management information systems in Nepal and Ghana reveals a framework of seven steps: (i) situational analysis, (ii) design of integrated MIS, (iii) field-test (prototype and training, methods/materials), (iv) participatory revision (re-examining the overall strategy), (v) implementation (expansion of the programme through training), (vi) system utilisation/peer performance review and (vii) system review and evaluation. Perhaps the framework elaborated by Campbell could be simplified by combining steps (i) and (ii) into one component, which could be termed design and development, as these are activities in the course of developing an IS, and steps (iii), (iv), and (v) into another component as implementation, because these bear on how data are collected, analysed and utilised. It should be noted that utilisation of information in M-HISE falls under both implementation and output. It is anticipated that facility workers will use the information as part of the implementation at the same time as the system is producing usable information as one of its outputs.

7.5.1 General characteristics of information systems

According to Robert et al. (1992), most information systems have characteristics in common with those shown in Figure 13. Data are first collected from various sources, entered into the system, processed into information output and transformed for various users for their transaction needs: processing, reporting and decision-making. Generally input processing and output processing steps involve several functions. Transaction data are captured and entered into the system at the source of the transaction, and external data are captured and entered into the system from various sources outside the organisation. These data are then classified and stored in a database or a set of files for further processing. Thereafter, the process continues as information is needed for reports, and in response to management enquiries. Data are then stored, summarised, and analysed using different methods to provide useful information for management.

The information output may consist of routine reports developed by the information system analysts and programming staff, on-the-spot enquiries using system, and end-user development reports. There is a control system to regulate the flow and quality of this process and its stored data. Generally there is a feedback loop whereby the results of various measures taken on the basis of the information are fed back into the information system for future use. The overall process takes raw data and adds value to it by processing it to become a valuable resource for managers to utilise. In general data are transformed into useful information using data-processing procedures (Robert 1992)

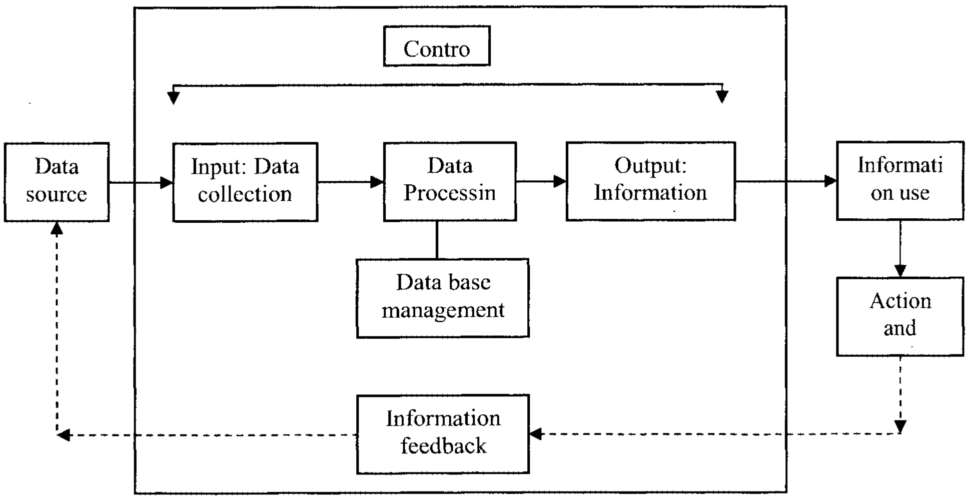


Figure 13. Characteristics common to all information systems. Source: Robert et al 1992.

7.5.2 Information system structure

The system structures links functional decision-making activities and data processing elements of the organisation in order to provide management with information. The information system literature indicates that numerous types of systems exist to support a variety of organisations. Most information systems can be classified as centralised or distributed systems, and can either be integrated or take a component approach.

Finally, it must be admitted that the Multidimensional model for Health Information Systems Evaluation has shortfalls which need further research for improvement, as has also been appreciated by earlier model constructors DeLone and McLean (1992) who admitted "there might be some weaknesses in our model", while Bonner (1995) cautioned that the new factor *information awareness* will not be added in his model, as more research was required to determine how and where it fits. These uncertainties imply that even with the identification of a shortfall in a model, it is not only difficult to add or reduce variables without research, but also the location in the model matters.

7.6 General summary

A noticeable increase in the development of Health Management Information Systems has been observed in developing countries since the early nineteen-eighties. Currently, the need for evidence-based policy and decision-making in order to use the scarce resources available and allocated to public and private health institutions cost-effectively is the driving-force behind this trend. This was acknowledged in the attempt to achieve Health For All by the Year 2000 (WHO 1981c, 1987 & 1992). As such, the World Health Organisation has committed itself to assisting member countries in the struggle towards achievement of this global goal (WHO 1987). Despite a huge effort to reform information systems in developing countries, the WHO global report noticed that information systems in many health care organisations are inadequate (WHO 2000).

Although initiatives to reform health reporting systems started in the mid nineteen-eighties, the current integrated Health Management Information System in Tanzania was put in place between 1994 and 1997. Consequently there was every reason to conduct this cross-section evaluative study in two districts (Mbarali and Mbeya rural) of Mbeya region from May 2000 until the end of August 2000. This study had four overall objectives: *first,* to describe the health information systems in Tanzania, which was attained by (i) describing the design/development of the Health Management Information System, and (ii) identifying the type of data collected at primary health care (PHC) facility level and the data handling and transmission at different hierarchical levels; *secondly*, to examine the quantity and quality of collected data, attained by (i) appraising different tools for data collection for the year 1998, and (ii) assessing primary facility workers in respect of their knowledge of HMIS, attitude towards HMIS and motivation by salary; *thirdly*, to examine data utilisation at different hierarchical levels; *and fourthly*, to construct a framework or model for health information systems evaluation.

A combination of sampling methods (purposive, multistage random sampling and convenient sampling) was applied at various levels to obtain the study location, and the materials and respondents to be included in the study. In particular, purposive sampling was used to obtain the region of interest. Multistage sampling was employed to select two districts among eight in the region like wise in the selection of health centres and dispensaries. Simple random sampling was applied in the selection of data collection tolls to be assessed for data quality. Respondents across all levels were conveniently obtained. Consecutively qualitative and quantitative methods were engaged to collect data from among 85 respondents from primary, secondary and tertiary levels of health care delivery and administration. A range of tools; three distinctive questionnaires, question guide for focus group discussion and check-list were used to collect the entire data, and the data were analysed by the use of scientific package for social science (SPSS versions 11 and 11.5) and presented in the form of tables, graphs and narration and themes for the FGD and in-depth interviews.

In setting up the information system in question, the principles advocated by the World Health Organisation were adhered to: the use of its experts as advisors, donor support and the use of local experts in the development and implementation of the management information system. Principles not adhered to included the need for an information policy and the use of the participatory approach, a strong tool that became popular after Alma-Ata declaration on Health For All by the Year 2000 (Tatar 1996, Kelly 1996). A series of working group meetings were conducted at the ministerial level before the system was approved for pre-testing in selected districts of the country, conforming to the experiences from Ghana and Nepal as reported by Campbell (1997). Issues related to goals and objectives of the IS, setting indicators and criteria for allocating catchments areas, pattern of information flow and supervision for undertaking of HMIS among other management and financial issues dominated the plans. Significantly, the pre-test showed the necessity to substitute the fragmented health information reporting system by the new integrated one.

Even though no policy on the information system has been developed, the existing national health policy of 1990 mandates the collection of HMIS data. The non-existence of a policy provided some loopholes for institutions to violate the whole exercise of data collection and transmission. Thus there is still a need to have an independent policy on information within the Ministry of Health. There is a well-planned information flow with set timing. However, this study shows that the set timing fails to take precisely into account the timing at the primary facility level, which has its own internal flow. In the absence of this awareness, delays of information flow to the district level have always occurred, resulting in minor disciplinary actions taken against heads of facilities. Thus there is a need to review the whole time schedule for information submission.

Training of staff was deemed crucial before implementation of the IS, thus a trainer of trainers approach was used in the training. However, the study reveals that not all workers implementing the HMIS were trained. There is a continuous emergence of workers that are not trained in the management information system among new graduates, as so far there is only one medical institution that has incorporated HMIS in its curriculum. Training and other administrative logistics were facilitated by funds from different donors and was conducted according to the schedule prepared by the Ministry of Heath bringing the whole concept of participatory approach.

The quality of information in terms of completeness, correctness and cleanness of data collection tools has been found to be poor. This makes it hard to trust the validity and reliability of the information generated, perhaps limiting its use. Incomplete tables, noticeably erratic recording of drug dosages and diagnoses, and incorrect addition of numbers of items were found among the data collection tools. The poor quality of information is contributed to by factors related to large amount of information required and collected within the health care system, which does not allow facility workers to attend patients well or do better in data collection.

In addition, poor supervision has been found to be a cornerstone in the overall issue of quality. Like the primary facility workers, some District and Regional Health Management Team members entrusted with the role of supervision are also not trained, compromising their ability to render supportive supervision to HMIS operations in particular. Consequently there is a need to retrain workers and train newcomers in the overall operation of the HMIS. This training could be sustained by incorporating HMIS in the curricula of medical and paramedical institutions. Other factors contributing poor quality of information are related to lack of incentives to motivate workers perform their duties. A great majority of the primary facility workers were dissatisfied with their monthly salary and were not paid outreach allowances, unlike their supervisors who receive lunch or per-diem allowances for supervisions they perform. Altogether, financial incentive issues demoralise primary facility workers in their day-to-day undertakings.

Another factor limiting the success or effectiveness of the information system lies in the use of the information generated from the system. Although the study has found that there is some day-to-day use of the information, still primary facility workers, DHMT and RHMT members have not done enough in terms of information utilisation. There is a great need to build the capacity of workers across all levels on evidence-based planning.

In its final part, the study has made it possible to construct a framework that can be used to design and evaluate health management information system. This Multi-dimensional model for Health Information System Evaluation is based on the common characteristics of HMIS: input, process and output. This user-friendly model gives the evaluator a range of opportunities to evaluate information system at any level. However, like any other model, it may have weaknesses which could be accordingly improved.

8 CONCLUSIONS AND RECOMMENDATIONS

8.1 Conclusions

Lessons learned: The first conclusion that can be drawn is the richness of information available on health management information. There is a vast body of knowledge related to information systems, management, organisation and health care systems as well as information technology and communication. Relevant research has been conducted in both the developed and the developing world. There is a great difference between the information systems in place in the developed world and those available in developing countries. In the developed world and middle-income countries, computerised information systems predominate, while less developed countries have systems which are partly manual and partly computerised at the higher levels. This constitutes further evidence of the global digital divide.

The use of appropriate methods employed in this study constitute one of the strengths of the study, as the application of a variety of qualitative and quantitative approaches enabled the acquisition of a wide range of responses from the respondents across all levels. However, in contrast to my previous perception, I came to hold the view that group discussions could also have been used to obtain information from the District and Regional Health Management Teams.

Issues of validity and reliability are very significant when undertaking any scientific study. In this study, these issues determined the selection of the study areas, respondents, and research assistant and the development of tools for data collection. The results can therefore be considered reliable. However, I would comment that studying information systems is no simple task, especially for a single researcher. I would advise that such a task should preferably be carried out by a well-funded research team, perhaps by studying one segment of the system rather than the system across all levels. Consideration should also be given to the inclusion of as many health facilities, district and regional health management team members and Ministry of Health officials as possible. In other words, this study should be conducted again on a larger scale.

On the basis of the available literature and the findings of the current empirical study, it can be concluded that most of the information systems so far developed are weak: in one way or another, these systems fail to meet the basic aim for their development. Many of the problems lie in the design and development of information systems, the quantity and quality of information collected, incomplete use of the information for decision-making and planning, lack of human resource management in terms of training in both the information system itself, the collection, analysis and use of data, and in continuing education in general. Workers are less motivated to carry out their day-to-day operations as a result of a system of incentives which is unfair to some categories of workers. In a broader perspective, the strengths and weaknesses of the management information system in the following areas can be highlighted.

Design and development: Evaluating the Health Management Information System in Tanzania reveals that a participatory approach in the management information systems development is crucial: different stakeholders play different roles in enforcing different tasks. The Ministry of Health in Tanzania, in collaboration with donors and other stakeholders, following World Health Organisation guidelines and recommendations to a great extent, as well as experiences accrued from other countries, succeeded in putting in place a working Health Management Information System in the years 1994-1997. The different parties committed to the development of the system played an active role in attaining the goals set for the introduction of the system within the set timeframe. However, during the design, development and implementation of the system, major weaknesses lay in the following areas: failure to institute a policy for HMIS, inadequate involvement of actors especially from the grassroots level, insufficient training of those who would implement the information system, weak supervision especially by District Health Management Team members, and inadequacies in quality assurance of the information itself and in utilisation of the information generated.

Human resource training and development: Another important area in the development of health information systems concerns human resource training and development: workers of different professional groups implement the information system, and the quality of their training is crucial for its operation. The literature gives a broad view of methods of training: the approach used in Ghana, Nepal and Mozambique (training within the health facility) differs from that used in Tanzania (residential, away from facilities). The former might be the cheaper way, but ultimately more expensive in terms of how much time and knowledge is imparted to the recipients. Training and facilitation efforts need to take into account broader infrastructure constraints, the level of knowledge and skill of workers, and the duration and timing of the training.

Quantity and quality of information: The existing literature on experiences from other studies shows that a vast quantity of data is collected, compelling facility workers to use much of their time in collating and compiling data rather than attending to patients. A similar situation prevails in Tanzania. However, this had little impact on facility workers' attitudes to the information system, as they considered that the information collected by the system is all necessary, and if not collected by them will never be available at other hierarchical levels.

Information use: The information collected consumes many resources in terms of time, money and materials, but is still not fully utilised for policy-making, decision-making or future health development plans. Although some planning at primary health facilities is based on the information collected, there is no evidence of action-led decision-making, and even when plans are made from information aggregated, there is no culture of referencing the source, which makes it difficult to measure the usability of the information. Lack of training in data analysis and use of information for planning and decision-making hinders facility workers at different levels from effectively utilising the valuable information that is collected. Perhaps this could be one of the major areas where the Ministry of Health could inject resources to build the capability of decision-making based on evidence. Another concern with inadequate use of information for decision and planning lies in the quality of the data: improving data quality could encourage workers to trust the data and ultimately develop a positive attitude towards data utilisation.

Supervision: The supervisory plan which has been introduced is very practical. However, supervision especially by the District Health Management Team of primary health workers is ineffective. Combined with other deficiencies, the poor quality of supervision contributes to the deterioration in the quality of the date being collected and transmitted. In addition, the lack of effective supervision probably contributes to the malfunctioning of other aspects of the information system, such as information utilisation for sound decision-making. Primary facility workers are not motivated to conduct the required and necessary village visits. Incentives to motivate them carry out the task are minimal given that reliable information to support communities is considered so important. Even almost ten years after the implementation of the information system in the country, there still exist inconsistencies in the frequency of supervision of the DHMT and especially by the DHMT of the facilities.

Performance: This study has been conducted in an ideal setting, involving as it does different levels of the health care system. It has incorporated a variety of workers involved in information collection, aggregation and use. The environment (health care system) of the country in question is explained. The study took into consideration the need for scientifically acceptable methods of data collection and the necessary procedures for the undertaking of a scientific study. Some weaknesses have been experienced, such as the sample size, lack of group discussion at certain levels, lack of a research team and insufficient funds to conduct an extensive study.

Need for future research: If it is accepted that most management information systems, in particular health management information systems, have the weaknesses reported in this study and in other studies reviewed, there is a need for extensive follow-up research on certain areas within the health care system, in particular on the supervision and training of workers at various levels of the system. Further study should also be carried out on how best facility workers can be rewarded, so that they can perform their duties well with little resources. It would also be useful to study the ability of workers to analyse and use information for day-to-day planning and management, and the impact of the information system on patients' waiting time.

8.2 Recommendations

On the basis of the above conclusions, the following recommendations seem appropriate:

Replicating the design of the Health Management Information System: Given the effective and efficient design, implementation and development of HMIS, other countries of the developing world are recommended to study the Tanzanian experience and possibly adopt such a system. However, other designers should consider issues such as putting in place a Health Management Information Systems Policy before the implementation of such a system. The policy issue has been among the weaknesses in the Tanzanian context. In designing the approach, and in evaluating health care information systems, the multidimensional model for evaluating information systems presented here could be considered.

Training of health professionals in HMIS: The Ministry of Health in Tanzania should consider that it is now mandatory to incorporate the HMIS in the curriculum of medical and paramedical institutions. Similar recommendations were also made by Health Research for Action (2000). Retraining of health facility workers should be given priority: DHMTs should be instructed to incorporate in their comprehensive health plans refresher courses on MTUHA for DHMT and facility workers. The training for facility workers, DHMT and RHMT members and for professionals up to the level of the Ministry of Health should focus on data analysis, data interpretation, and the utilisation and dissemination of the information generated by the system.

Similar recommendations have been made by Health Research for Action (2000) and by Kalowela (2000), however, so far little has been done. Other studies conducted elsewhere have also come up with similar recommendations, but the information system designers and implementers seem to fail to introduce pragmatic measures of this kind. The medical and paramedical institutions should take a leading role in the training to ensure sustainability, and should continue to offer such training as a standard part of the curriculum. This will avoid the turnover of untrained workers involved in the implementation of the information system.

Supervision: Supervision as practiced especially by the DHMT to facility workers should be reviewed. More emphasis should be laid on how to assist facility workers to meet the criteria for quality information. The provision of motivating incentives to facility workers to make effective village visits should also be under consideration. The money collected by facility workers as cost-sharing fees could be used as a starter while a permanent solution is being worked out.

Research on HMIS: Well-timed evaluation of the Health Management Information System continues to be needed at both local and global levels. The results of such evaluation should be aimed at increasing the efficacy of information systems.

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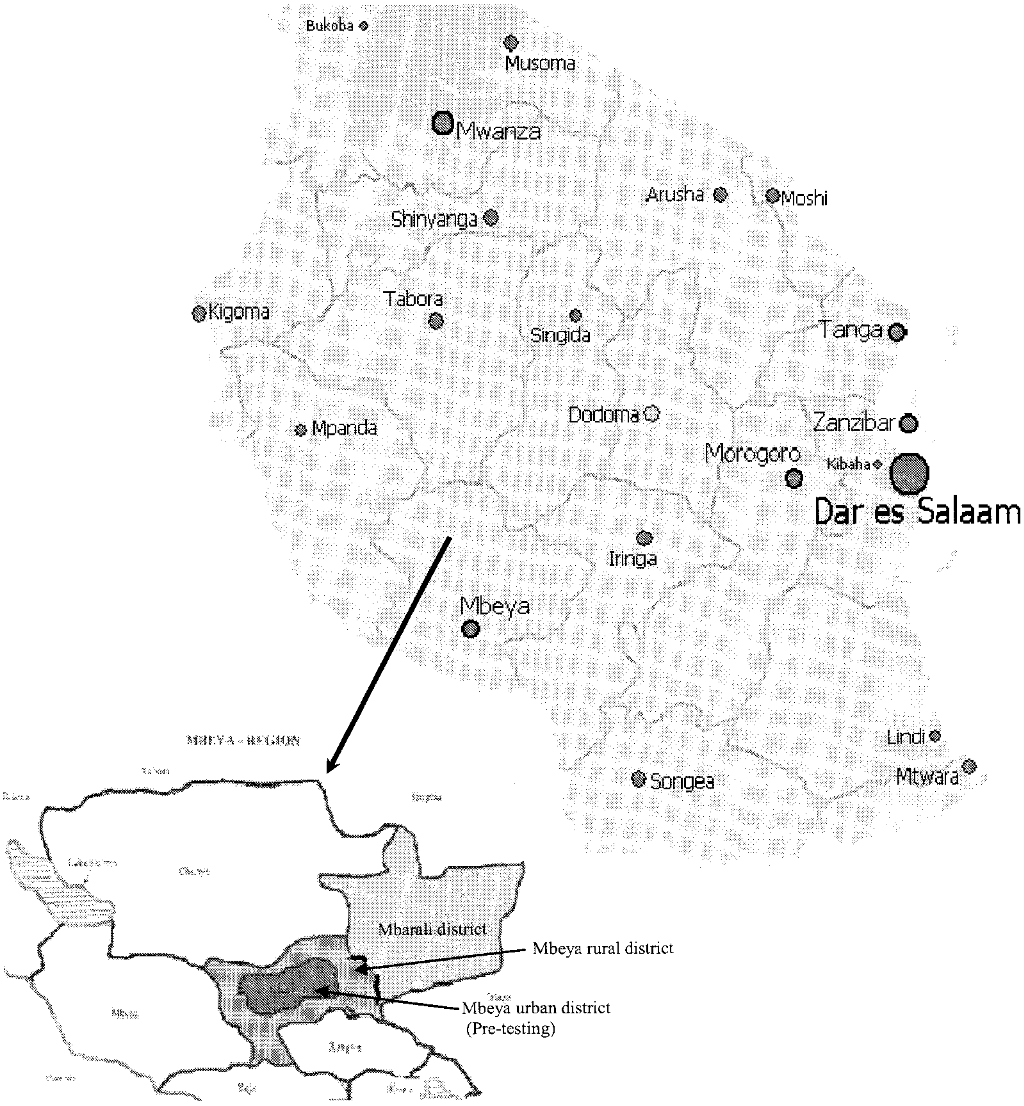
GLOSSARY OF HMIS TERMS

Catchment area	Geographical area for which a health facility team has the responsibility of supplying integrated health services
Catchment population	Number of people living in a given catchment area
Coverage	Degree to which services has been provided to the people who need it in a given catchment's area
Data	Facts collected about the health services which have not been analysed
Denominator	The lower portion of a fraction. In the HMIS context, this is usually the number of interventions that should have been achieved, related to the target population
Feedback	Information provided by a supervisor on the way a person is doing work.
Growth monitoring	To regularly check the weight gain of a child
Indicator	An indirect measure of achievement of a target
Information	Data which have been analysed into indicators and is ready to use for decision making
Integration	The process of combining different services in to a whole
Monitoring	To closely observe or check the achievements of the health service on a regular basis
Numerator	The upper portion of a fraction. In HMIS, this is the actual number of interventions performed
Objective	Desired aims of programme managers
Outreach	A system of providing comprehensive health care in which health workers travel to communities that would not otherwise have access to health services
Population	Number of people
Proportion	The relationship of a part to the whole, often written as a percentage
Quality	The degree or level of excellence in providing health care
Sense of ownership	The community's feelings/belief that the program belongs to them and they have a commitment to the problem/issue and/or program
Service area	Defined as the communities that have been allocated by the authority to a particular health facility
Supervision	Support given to workers by superiors to educate, evaluate support and motivate their staff
System	An organised grouping of people, things and procedures devised to achieve a certain objective
Target	Objectives that have been made more specific and qualified in terms of time
Target population	People for whom a service area is primarily (or solely) intended
Team	A group of people working together towards a common goal
Training	The process of helping people to learn how to do specific tasks

APPENDICES

Appendix i Map of Tanzania showing regions of the country and the study area in annexed region



Appendix ii QUESTIONNAIRE FOR DISPENSARY AND HEALTH CENTER WORKERS

Faculty of Social Science,
Department of Health Policy
and Management- University of
Kuopio
P.O. Box 1627
Kuopio-Finland

Instructions for the questionnaire

a. Each question provided with a box has only one answer. Fill the appropriate response (number) in the box provided on the right side of the question.
b. Not applicable, not involved... etc can be selected only if the respondent is not responsible for that particular activity in inquiry.

01. Name of the district...................................... 02. Date ....../........./........

03. Name of institution/DHMT .... 04. Interviewers code no. [ ]

05. Health unit [ ]
1. Dispensary
2. Health centres

06. Health unit ownership
1. Public
2. Private

07. Name of respondent...

08. Title of respondent [ ]
1. Assistant medical officer
2. Clinical officer
3. Assistant clinical officer
4. Public health nurse
5. Maternal and child health aide
6. Nurse midwife
7. Medical attendant
8. Laboratory assistant
9. Record assistant
10. Others
Specify..

09. What is the level of your basic education? [ ]
1. Below seven years in school
2. Seven years in school
3. Above seven years, but did not complete ordinary level secondary education (OLSE)
4. Eleven years in school (completed OLSE)

5. Above eleven years in school, but did not graduate
advanced level secondary education (ALSE).

6. Above eleven years in school (graduated ALSE).

10. How long was the duration of your professional training?
1. No formal training
2. One year and below [ ]
3. Two years
4. Three years

11. For how long have you been working in your current professional?
Mention...

12. What system of information collection do you use in this health unit?
Mention...

13. Can you explain what is meant by health management information system/MTUHA?
Explain (swahili/english acceptable)
....
....
....

14. How did you know about HMIS information system?
1. I attended formal training
2. I was briefed by co-workers
3. I attended formal training
4. Taught during my professional course
5. Taught by co-staff

15. If attended formal training, how long was the training?
Mention...
Not applicable [ ]

16. If attended formal training or taught during professional course, when was that?
1. Less than one year ago
2. One year ago
3. More than 2 years ago
4. More than four years ago [ ]
5. Not applicable

17. Have you ever-collected health information using another system than the current one?
1. Yes
2. No [ ]

18. If yes what was the name of the information system?
Mention...

19. Can you tell any advantage or disadvantage of health management information system?

Advantages	Disadvantages
………………………………………………..	………………………………………………….
………………………………………………..	………………………………………………...
………………………………………………..	………………………………………………...
………………………………………………..	………………………………………………...

20. If no advantage, what is your opinion about the information system?
Mention

………………………………………………………………………
………………………………………………………………………
………………………………………………………………………

Not applicable [ ]

21. Do you think that this new information system (HMIS) obtains all the necessary information required or it enquires more than what is necessary?
1. All
2. Not all [ ]
3. More than necessary
4. Not applicable

22. If not all information is obtained, what do you think is missing?
Mention

…………………………………………………………………
…………………………………………………………………
…………………………………………………………………

Not applicable [ ]

23. If more than necessary, what do you think should be excluded?
Mention

…………………………………………………………………
…………………………………………………………………
…………………………………………………………………

Not applicable [ ]

24. How long does it take you to complete collecting all necessary information from a patient/client?
Mention (minutes)

…………………………………………………………………
…………………………………………………………………
…………………………………………………………………

25. What are your comments with regard to time used to completely collect all necessary information from a patient/client?
Mention

…………………………………………………………………
…………………………………………………………………
…………………………………………………………………

26. How long does it take you to prepare the monthly report?

Mention...
Not involved in report writing [ ]

27. What do you do with the information you collect?
Explain
....
....
Don't Know [ ]

28. How does the collected information assist in your day-to-day work?
Explain
....
....
....

29. When do you send your monthly report to the upper/district medical officer's office?
Mention...

30. What happens if you do not send or you send late your report to the DMO's office?
Mention
....
....
....

31. What actions are taken to you if you delay to send your report?
Explain
....
....

32. What do you expect from the district level from the information you send?
Mention
....
....
....
....
....

33 What are the most problematic indicators, which are difficult to reach the targets?
Mention
....
....
....
....

34. Do you normally receive any written comments or any information regarding your reports sent to the DMO's office?
1. Yes
2. No [ ]

35. Can you show me evidence of written comment you received from the DMOs office?

1. Evidence seen
2. No evidence seen [ ]

36. Can you explain how the information you collect helps you to make decision for your daily activities?
Explain
....
....
....
....
....

37. What do you think could be done to improve this information system?
Mention ....
....
....
....
....
....

38. Does your salary motivate you to work?
1. No
2. Yes [ ]

THANK YOU FOR YOUR COOPERATION

Appendix iii QUESTIONNAIRE FOR THE DISTRICT HEALTH MANAGEMENT TEATM [DHMT]

Faculty of Social Science,
Department of Health Policy
and Management- University of
Kuopio
P.O. Box 1627
Kuopio-Finland

Instructions for the questionnaire

a. Each question provided with a box has only one answer. Fill the appropriate response (number) in the box provided on the right side of the question.
b. Not applicable, not involved... etc can be selected only if the respondent is not responsible for that particular activity in inquiry

01. Date.............................. 02. Name of respondent.....................

03. Name of District/DHMT ....

04. Title..

05. Level of education..

06. Duration in the DHMT...................................

07. How many registers are there in a health unit?
Mention ....

08. What is the role of the DHMT in MTUHA supervision?
Mention
....
....
....
....

09. How do you make decision from information submitted from primary health units?

10. How often do you supervise a health unit?
Mention ....

11. At what time do you start your supervision trip?
Mention...

12. What is the distance of the furthest health unit from the district health office?
Mention..............................Km

13. Can you show your supervision checklist guide?
1. Checklist shown
2. Checklist not shown [ ]

14. During your supervision as a supervisor, what actions do you take in case of incorrect/incomplete/unclean information in data collection tools?
Mention ……………………………………………
……………………………………………
……………………………………………

15. What incentives do you get during your supervision?
Mention ……………………………………………

16. What incentives do health unit workers get for village visit?
Mention ……………………………………………

17. When do you receive reports from the health units?
Mention ……………………………………………

18. Are there health units, which delay reports?
1. Yes
2. No [ ]

19. Are there indicators, which their targets are difficult to attain?
1. Yes
2. No [ ]

20. If answer is yes to question 19 above
Mention them
……………………………………………
……………………………………………
……………………………………………
……………………………………………

21. What actions does the district take on reports of damaged equipment/or structures?
Mention
……………………………………………
……………………………………………
……………………………………………

22. If no action, do you think that this contributes to poor performance by the health units?
1. Yes
2. No [ ]

23. When do you send your report to the RMO?
Mention ……………………………………………

24. What actions are taken by the RMO in case you delay to submit your report?
Mention
……………………………………………
……………………………………………

25. Do you receive any feed back from upper level?
    1. Yes
    2. No [ ]

26. Does every DHMT member know how to complete the district HMIS report?
    1. Yes
    2. No [ ]

27. How many times have you attended MTUHA seminar/workshops?
    1. Once
    2. Twice
    3. Thrice [ ]
    4. More than thrice

28. Do you know why MTUHA version one was changed?
    Explain
    ....
    ....
    ....

29. Has there been any seminar after introducing version two registers?
    1. Yes
    2. No. [ ]

THANK YOUR FOR YOUR COOPERATION

Appendix iv. QUESTION GUIDE FOR THE REGIONAL HEALTH MANAGEMENT TEAM [RHMT] MEMBERS

Faculty of Social Science,
Department of Health Policy
and Management- University of
Kuopio
P.O. Box 1627
Kuopio-Finland

Instruction for the questionnaire

a. Each question provided with a box has only one answer. Fill the appropriate response (number) in the box provided on the right side of the question.
b. Not applicable, not involved... etc can be selected only if the respondent is not responsible for that particular activity in inquiry

01. Date............../...................../200102 Name of RHMT ....

03. Title of interviewee...

04. Professional Qualification ....

05. Level of education of interviewee ....

06. Sexual characteristics of interviewee
1. Male
2. Female [ ]

07. Duration in the RHMT ....

08. Did you attend any training on MTUHA?
1. Yes
2. No [ ]

09. If yes to question 07, how long was the training?
Mention...

10. If no, how do you manage with MTUHA?
Explain ....

11. Were you involved in MTUHA training for the district and health unit staff?
1. Yes
2. No [ ]

12. If yes, how long was the training?
Mention...days

13. What is the role of the RHMT in MTUHA?
Explain
……………………………………………………………
……………………………………………………………
……………………………………………………………
……………………………………………………………

14. How often does the RHMT supervise the DHMT?
1. Once in a month
2. Once in three months [ ]
3. Once in six months

15. How long does it take to supervise one DHMT?
Mention………………………………………………………………

16. Do you receive any allowances during DHMT supervision?
1. Yes
2. No [ ]

17. When do you receive MTUHA report from the district level?
Mention ………………………………………………………………

18. Are there some districts, which delay to submit their MTUHA reports as required?
1. Yes
2. No [ ]

19. What action are taken to districts which delay to submit their MTUHA reports as required?
Mention………………………………………………………………

20. When is the RHMT supposed to submit MTUHA report to the Ministry of health?
Mention…………………………………………………………………

21. What plans for the districts do you make from submitted MTUHA report?
Mention
………………………………………………………………
………………………………………………………………
………………………………………………………………

22. Are there indicators, which are difficult to reach their target?
Mention
………………………………………………………………
………………………………………………………………
………………………………………………………………

23. What actions are taken for indicators, which are not attainable for a long time?
Mention actions
………………………………………………………………
………………………………………………………………
………………………………………………………………

24. Some elements in MTUHA version 1 were changed, what was the reason?

…………………………………………………………………

…………………………………………………………………

…………………………………………………………………

25. After introduction of MTUHA version 2, have you attended any training?
1. Yes
2. No [ ]

26. What are your suggestions for the improvement of MTUHA?
Mention

……………………………………………………………

……………………………………………………………

……………………………………………………………

……………………………………………………………

THANK YOU FOR YOUR CO-OPERATION

Appendix v: QUESTION GUIDE FOR FOCUS GROUP DISCISSION

Faculty of Social Science,
Department of Health Policy
and Management- University of
Kuopio
P.O. Box 1627, 70211 FIN
Kuopio-Finland

The intension for establishing the HMIS was to collect routine health care and health care logistic data that will enable decision makers at different level of health care delivery make sound decisions that will enhance better services delivery hence minimise/solve prevailing health problems within the community. As a one of the implementer of the system what views do you have on the system?

HMIS has its working indicators, which among them are problematic or hard to attain?

One of HMIS indicators is to carryout outreach visits to villages within the facility catchments area, is this task attained by your facility workers?

Training on HMIS was carried out before the initialization of the system, were you involved in the training?

Appendix vi: THE CHECKLIST FOR ASSESSING DATA COLLECTION TOOLS (completeness, correctness and cleanliness)

Faculty of Social Science,
Department of Health Policy
and Management- University of
Kuopio
P.O. Box 1627, 70211 FIN
Kuopio-Finland

a. The observation checklist is intended to assess the availability of different data collection tools at respective level.
b. Each tool should be examined for cleanliness, correctness of data and completeness according instructions given in the tool or according to MTUHA specifications. For some conveniences mark only when discrepancy is found on a specific tool e.g. Book 4 not clean, Form F004 not completed etc.

Parameter Availability	Type of tool	Not Available	Incomplete/incorrect/unclean
Completeness	e.g. form F004 F101 OPD register	√ (June, 1998)	√
Correctness			
Cleanliness	Book 4		√

Note: For some conveniences, a textbook was used to complete the exercise. This enabled supplementary comments to be recorded.

Appendix vii GUESTION GUIDE FOR INDEPTH INTERVIEW AT THE MINISTRY OF HEALTH

Faculty of Social Science,
Department of Health Policy
and Management- University of
Kuopio
P.O. Box 1627, 70211 FIN

Kuopio-Finland

1. Establishment of MTUHA
- Is there a specific policy on MTUHA?
- What were the processes for the establishment of MTUHA countrywide?

2. Who were responsible in the HMIS development as well as training?

3. A huge amount of money is needed to establish an information management system, who were the major funders of the system?

4. Before initialization of MTUHA, health personnel's at different levels were trained. However, with the implementation of structural adjustment programme (SAP) highly fancied by the World Bank and the international monetary fund (IMF), as well as other factors such as death and retirement and the ever-increasing newly graduated professionals entering in the health care system, it is so that at present many MTUHA implementers are not formally trained. Given the case, are there any future plans to train and retrain workers?

5. What are the roles of the MTUHA unit in the ministry of health in MTUHA implementation?

6. MTUHA is regarded as the sole way for collecting routine health information, what are the future plans for sustainability after donor's withdrawal?

7. Incentives for motivation are a factor that promotes a person to work better. How does this fit to MTUHA implementers at different levels?

8. Supervision is one of the cornerstones of job enrichment, and one way of monitoring the implementation of any project, what are the strategies for MTUHA supervision?

Appendix viii DISCREPANCIES IN THE QUALITY OF DATA

Type of tool	Observed weakness	MTUHA recommendation	Remarks
Book 4 (ledger)	. place where stock obtained from not recorded . no remarks through out . maximum and minimum stock to order not indicated . condition of storage not given . supplies balance no given . no indicated on how balance of supplies was obtained . district and centre number not recorded . no date when register started or finished . incorrect data e.g. Family planning pills recorded as 5-4=0 . name of facility not recorded . item number not recorded . cleanliness of ledger not maintained . missing items not explained for (1 cycle of F/P pills)	. place where stock is obtained from must be recorded . remarks when needed . must record maximum and minimum stock on every page . condition for storage must be reported . balance necessary on each page end . must explain how balance was obtained . must record district and centre number on cover page . must record register starting and finishing date . correct data must be ensured . must record facility name on cover page . item number must be recorded . cleanliness must be maintained . explanation in case of loss of item	
Book 5 (OPD register)	. cases recorded beyond recommended lines . improvised columns for DoD, transfer out,	. must record on space provided	. register should include column for such

	absconders, deaths, stay duration and totals		comments
	. age are recorded in fractions	. age to be rounded	. age must be rounded
	. more than one diagnosis recorded in the same line	. one line for one diagnosis	. one diagnosis in one line
	. male, female and children patients not distinguished according to wards	. male , female and children must be recorded appropriately	
	. register used continuously to record patients even after end of the year	. a new book is recommended or skip one page after ending of the year	
	. doses of medicines recorded in terms of spoons instead of millilitres (mls)	. doses must be prescribed/recorded in standard units	
	. Age of patients not given, recorded as adults	. age of patient must be recorded	
	. one report book was not found (Nsonyanga disp.)	. books must be well stored	
	. signs and symptoms repeatedly recorded instead of diseases e.g. cough, fever, heart palpitation, and abdominal pain	. correct diagnosis must be given	
	. number of patients not correctly given e.g. 9019 next 20, 21, 22 instead of 9020, 9021 and so on	. Patients serial number must be given in full	
	. listing of drugs in the same line	. one kind of drug in own line as diagnosis	
	. patients with no diagnosis but prescribed with medicines	. no drugs for in absence of disease	
	. patient diagnosed as having pneumonia treated with aspirin only, while others with same condition receive antibiotic as well as	. rational medicine prescription according to diagnosis	

	aspirin, insect bite treated with antibiotic		
	. register finishing date not recorded	. must recorded date for register finishing	
	. many patients recorded as PUO	-	
	. numbers listed but no patients, diagnosis nor treatment recorded	. number entered only after a patient is attended and not otherwise	
	. mal-diagnosis, nutrition treated with ferrous sulphate	. proper diagnosis and proper medicine	
	. name of facility not given on the book	. must record name of facility on book cover	
	. Cleanliness not maintained	. Cleanliness must be maintained	