

**DECENTRALIZATION AND SUSTAINABILITY OF ICT BASED HEALTH INFORMATION  
SYSTEMS IN DEVELOPING COUNTRIES: A CASE STUDY FROM TANZANIA**

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## PREFACE

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1. Kimaro, H. C. & Twaakyondo, H. H. (2005). Analyzing the hindrance to the use of information and technologies for improving efficiency of health care delivery system in Tanzania, *Tanzania Health Research Bulletin*; 7(3), 189-197.
2. Kimaro, H. C. & Nhampossa, J. L. (2004). The Challenges of Sustainability of Health Information Systems in Developing Countries: Comparative Case Studies of Mozambique and Tanzania. In. Leino, T., Saarinen, T. & Klein, S. (Eds.), *Proceedings of the 12<sup>th</sup> European Conference on Information Systems (ECIS) on the European IS Profession in the Global Networking Environment*. Turku, Finland.
3. Kimaro, H. C. & Nhampossa, J. L. (2005). Analyzing the problem of unsustainable Health Information Systems in Less-Developed Economies: Case studies from Tanzania and Mozambique. *Information Technology for Development*; 11(3), 273-298.
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8. Kimaro, H. C. & Sahay, S. (2006). An Institutional Perspective on the Process of Decentralization of Health Information Systems: Case Study from Tanzania. *Information Technology for Development (forthcoming)*

## ABBREVIATIONS AND ACRONYMS USED

AIDS	Acquired Immune Deficiency Syndrome
DANIDA	Danish International Development Agency
DFID	Department for International Development
DHIS	District Health Information Software
DPF	District Processing File
EU	European Union
GIS	Geographical Information Systems
HDR	Health Development Report
HII	Health Information Infrastructure
HISP	Health Information Systems Program
HISs	Health Information Systems
HIV	Human Immunodeficiency Virus
HMIS	Health Management Information System
ICTs	Information and Communication Technologies
IDRC	Canadian International Development Research Center
IMF	International Monetary Fund
IS	Information Systems
IT	Information Technology
MoH	Ministry of Health
MoU	Memorandum of Understanding
NGOs	Non-Government Organizations
NORAD	Norwegian Agency for Development Co-operation
PHC	Primary Health Care
TB	Tuberculosis
TEHIP	Tanzania Essential Health Intervention Project
TPHA	Tanzania Public Health Association
UNICEF	United Nations Children's Fund
WHO	World Health Organization

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## ABSTRACT

Attempts to decentralize Health Information Systems (HISs) are ongoing in various developing countries as a part of health sector reforms. Donor communities in particular have often insisted on decentralization of health systems as a mechanism to encourage sustainability of health services and availability of timely resources at local levels by removing or reducing layers of bureaucracy. The decentralization of HISs along with the system of health care delivery is emphasized to support the efficiency and management of health services by incorporating local use of information in decision making and planning. Decentralization focuses on the transfer of decision-making, planning, budgeting, management, and resource allocation from the national level to the district and sub-district levels, so as to reduce costs and inefficiencies associated with a centralized system and to create a sustainable decentralized system. However, relevant literature in the domains of public health and information systems (IS) suggest that the goals of decentralization are not easily achieved because of the complex institutional context in which the decentralization process is carried out.

This thesis presents an in-depth theoretically informed and empirically based studies of the efforts to introduce, use, and sustain the computer based Health Information Systems (HIS) in the local setting of Tanzania. Theoretically, the aim is to understand the relationship between processes of decentralization and sustainability of computer based HIS. I argue in this thesis that the key to achieving a sustainable HIS is to address the complexities and challenges of the decentralization processes of health services and HIS and their inter-linkages. The research reported in this thesis is situated within an action research project called the Health Information System Program (HISP). The experiences of working at the two HISP pilot health districts in Tanzania is combined with a multilevel analysis of the existing HIS including at the health facility, district, regional and national levels.

The two research questions guiding this study are: 1) How can the relationship between decentralization of health systems and the HIS, and sustainability of HISs be theoretically better understood? and, 2) How can decentralization processes be conducted in a way that better enables the development of sustainable HISs? The research strategy adopted was based on an interpretive approach carried out within two health districts where the HISP initiative was ongoing and across four levels of the health sector of Tanzania during periods between 2003 and 2005. My empirical experiences helped me develop a rich contextual understanding of the existing processes around decentralization and the HIS. Empirical data was collected from 88 individual interviews as well as detailed study of formal reports, documents and publications, participant observation, and engagement in local activities such as training and software customization. In addition, passive observations was also carried out around the HIS related processes such as data collection registration, analysis and transmission to different levels.

The thesis is structured around 8 conference and journal papers, where 3 of them are published in international and peer reviewed journals. On summary, the findings relate to: 1) the lack of overlap between the imposed formal rules of the HIS and the existing local informal constraints due to lack of skills around HIS and information use, weak strategies for human capacity building, misalignments of interests between key actors, and a top down style of management which creates a strong dependency on higher levels for guidance and resources; 2) the lack of a wider legitimacy of the existing HIS due to its centralized control, inefficiency, and inflexibility affecting its further improvement as well as the lack of local ownership and participation; 3) The existence of contradictory influences of the various entities of an organizational field comprising the systems – political administrative, health administrative, and health delivery systems and the system of donor support. The efforts to implement the existing HIS have not been adequately aligned with similar work practices and institutions of these systems making the HIS inefficient and thus unsustainable. The donor supported vertical programs targeted towards specific diseases have their own parallel reporting systems which contribute to overburden an already busy health staff, and thus undermine overall decentralization efforts.

In analyzing the case study through various concepts drawn from institutional theory and information infrastructure perspective, the thesis develops key insights towards addressing this paradox. It is generally argued that HISs becomes sustainable if they are institutionalized in the sense of being integrated into the everyday routines of the user organization. However, HIS need not only to be institutionalized, but also be flexible to allow for changes as the user needs change, emphasizing the need for capacity to change the systems with the evolving needs of the organization. Thus, introduction of HIS is not only a technical change but also concerns institutional and organizational issues such as that related to culture and people issues. It involves cultivation of new cultures including ways of handling and using information for action, and sustaining HIS over time. A key implication concerns the need to develop both vertical and horizontal alignments, with respect to both the domains of the formal rules and informal constraints. Thus, a realistic changing strategy and alignment of interests needs to take an institutionalization and cultivation approach where the HIS is gradually integrated into the local setting through processes of socio-technical-political negotiations and participation of key actors in ongoing reform processes.

The contributions, both theoretical and practical, relate both to public health and IS research. A first key theoretical contribution concerns the development of a theoretical framework to analyze the relationship between decentralization of health systems and HISs, and sustainability of HISs. This framework elaborates upon four sets of relationships: how decentralization and sustainability are interrelated, and their mediation through processes of participation, capacity building, and other influences from the organizational field. Through this elaboration, the thesis contributes to debates around “sustainability” and “decentralization” in the contexts of public health and IS. Key practical recommendations developed are: 1) Minimize top-down driven reform efforts as it contributes to the lack of overlap between local informal constraints and imposed formal rules; 2) Emphasize the need to

take a holistic perspective to consider the various disparate influences arising from the multiple entities that comprise the organizational field; 3) Create a wider legitimacy of existing HIS through participation and political negotiations between various stakeholders and key actors involved to support its decentralization and sustainability; 4) Emphasize the need to align the various decentralization processes related to health delivery systems and HIS.

The various implications developed from this thesis have implications for use in the study of decentralization and sustainability of IS generally and HIS more specifically in similar contexts.

# CHAPTER 1

## *INTRODUCTION*

### **1.1 Research topic and motivation**

This thesis focuses on the decentralization and sustainability of Information and Communication Technology (ICT) based Health Information Systems (HISs) in developing countries, with a focus on Tanzania. Tanzania, like various other developing countries, is in the process of decentralizing its health system. Decentralization is a key aspect of health sector reforms in developing countries, being driven by various donor organizations including the World Bank (Litvack et al., 1998). Decentralization has also been a topic of study in IS research both more generally (for example, Walsham, 1992; Rockart & Leventer, 1976) and in the area of health information systems more specifically (Braa & Hedberg, 2002). However, despite its significance, the IS literature related to the decentralization has focused on technical and economic advantages and disadvantages of the decentralization against centralization configuration (King, 1983; Rockart & Leventer, 1976). The administrative, institutional, and political aspects of decentralization has not explicitly been a topic of IS and HIS research. The aim of this thesis is to understand both theoretically and practically the inter-linkages between processes of decentralization of health systems and the associated health information systems. Decentralization of health systems concerns the transfer of decision making power, resources, finances, and administration from the central to the district and sub district levels. Similarly, decentralization of HIS includes the transfer of budget, planning, management and control of HIS to the local level administration. While the decentralization of health systems is theoretically supposed to help create locally sustainable HIS, little is known of how this relation plays out empirically. This thesis seeks to analyze these relationships specifically involving the three concepts of decentralization of health systems, decentralization of health information systems, and the sustainability of HIS.

The concept of Primary Health Care (PHC) was officially launched in 1978 by the World Health Organization (WHO) in the Alma Ata conference (WHO, 1978) as the key strategy to achieving the WHO's goal of 'health for all'. PHC and a decentralized district based health system were part of the WHO's strategy to address issues of equity and accessibility of health care services in developing countries (WHO, 1994; Braa & Hedberg, 2002; Sandiford et al., 1992). PHC is now recognized by governments as a crucial element of a national health care delivery system that provides basic health services and outreach support to the rural population. Decentralization seeks to reduce costs associated with a centralized health care system and to create a more flexible, efficient and responsive system (in terms of quality and quantity) to deal with public health problems at the community level. Following Alma Ata, many developing countries like Tanzania have embarked on creating a decentralized health system based on the district health system structure. However, for a decentralized PHC system to be effective, it needs to be supported with an effective routine HIS that records epidemics, births and deaths (Byrne & Sahay, 2003) in order to help district health managers and health service providers to

take informed decisions. These decisions relate to the allocation of resources, the support of health services delivery and management, and the improvement of the quality and effectiveness of interventions in response to health related problems (Braa & Nermunkh, 2000). While in theory, the decentralization of health systems and health information systems (HISs) are mutually inter-dependent, in practice the planners and implementers of reform efforts treat these two sets of processes in an independent manner, leading to unrealized benefits of the reform efforts including the unsustainability of HISs. The challenges associated with decentralization are magnified in ICT based systems because technologies in themselves introduce their own complexities arising from needs related to physical infrastructure, trained manpower, and regular maintenance and training, which transcend mere technical considerations (Mills, 2000). In Tanzania, decentralization efforts of both health services delivery and of the routine HISs have been far from effective, and district managers continue to be plagued with the lack of reliable and systematic information to make decisions (Mwangu, 2003).

Decentralization of health systems focuses on the transfer of decision-making, planning (political), budgeting (financial), management, and resource allocation (administrative) of health care from the national to the district and sub-district levels (Litvack et al., 1998; Mills, 1990; Wunsch, 2001). Decentralization is thus a multifaceted phenomenon involving various institutions, actors, their practices and technologies. It is argued that by devolving power, authority, services and resources to local levels and involving local communities in planning, a sense of local ownership and involvement is established thus leading to more sustainable health systems (World Bank, 1993). Decentralization of HIS also implies creating local ownership, budget and resources to support the HIS, which theoretically should lead to more effective delivery of health services to the community level. Typically, HIS, if well designed and implemented, can potentially produce relevant information (for example, on the availability of drugs and supplies, coverage rate for various vaccines, etc) that can be used by health care managers to develop appropriate interventions at the community level, as well as support the formulation of effective policies at the higher levels. In this thesis, the analytical focus is on the two sets of processes related to decentralization of health services delivery and of HIS, their inter-linkages, and the implications this has for the sustainability of HIS.

As health delivery systems in developing countries are in the process of being decentralized, the demand for computer based HIS is also increasing dramatically (Braa & Blobel, 2003; Byrne & Sahay, 2003). ICTs are increasingly being implicated in health sector reform efforts, for example, to strengthen the processes of decentralization of health care delivery through the use of information to support local action and to integrate various health programs. However, successful HIS implementation is not merely about introducing new technologies, but also about understanding and managing the organizational change and institutional processes that surround it (Webster, 1995). In this thesis I argue that the key to understand the sustainability of HIS is to address the complexities and challenges of the decentralization processes of health services and HIS and their inter-linkages.

This requires developing a better theoretical understanding of both the institutional context and processes of change, which go beyond concerns of a purely technical nature.

Many ICT based reforms have over the years ended up as unsustainable, implying that they do not deliver in relation to what was initially expected of them by the organization and end users (Heeks et al. 1999; Heeks, 2002). Heeks et al. describe such failures of sustainability to arise from “design-reality” gaps. This reflects the gap between the design assumptions and cultures (Alvesson, 2002) of where the ICTs are produced, compared to the existing realities and cultures on the ground where such systems are used. Gaps may come in various forms including issues of commitment and the capacity and resources to effectively manage organizational change processes (Anderson et al., 1994; Heeks & Kenny, 2002). HISs, as compared to general purpose IS, are potentially susceptible to larger gaps because of the multiplicity of administrative levels involved and the multiplicity of diseases and their associated programs along with the institutions supporting them. HISs in developing countries have also historically operated in a top down and hierarchical fashion (Mwangu, 2003), thereby further hindering the decentralization process.

As a result of these complex operating conditions, processes of establishing decentralized systems are often based on a top-down design approach with limited participation of the local levels. This lack of local involvement has contributed to the unsustainability of various reform efforts (Walsham, 1992; WHO, 2001; Leighton and Knowles 1997), including those related to HIS. HISs are typically centrally planned, designed and managed. For example, indicators, reporting forms and data collection tools and procedures are usually designed by centrally located managers or international agencies with minimal involvement of the providers of health services at the lower level (Chilundo & Aanestad, 2004; Lippeveld et al., 2000; Lippeveld 2001; Walsham, 1992). As a result, routinely collected data tends to be of little significance for use at lower levels (Opit, 1987; Piotti et al. 2006; Gilson, 1995), for example to analyze trends in diseases and take action based on that. Consequently, this has raised some questions about the actual extent of decentralization of HIS in developing countries. As Hutchinson has indicated the “extent of decentralization is quite modest, restricted to only a few administrative functions” (Hutchinson, 2002, p. 5). The efforts towards full decentralization of HIS to create more sustainable district-based/locally based health information that can address the needs of local health management, has been widely acknowledged by various researchers (Lippeveld, 2001; Braa, 1996) and emphasized by the World Health Organization (Tamiro, 1991; WHO, 1994; WHO, 2004). As put forward by the WHO (2004):

*In the context of health sector reform and of decentralization, health systems are managed as closely to the population as possible, often at district level, in order to be more responsive to the needs of the people. This shift in functions between the central and peripheral levels generates new information needs and calls for an in-depth restructuring of Information systems with new requirements for collecting, processing, analyzing and disseminating data (P.43).*

While the implementation of HIS involves different levels, the local level which is the point of origin for most data, provides the foundation for the overall health system. Sustainability of the entire

HIS is thus highly dependent on achieving a strong base of a decentralized HIS. Currently, however, in the context of developing countries, the local levels (PHC delivery level) are significantly marginalized with respect to resources, are excluded from computer and physical networks, and are overburdened with heavy work loads (Mosse, 2005). Consequently, this leads to a paradoxical situation where decentralization is required to improve the marginalized status of the local levels, however, the local levels have to have the capacity to make decentralization work effectively in practice.

Decentralization of HISs is made further problematic because of their complex interlinking with various administrative, political and fiscal (revenue and expenditure) processes, which are in themselves also subject to similar processes of decentralization. For HIS reform efforts to be effective, they need to be compatible with similar processes in these inter-connected systems. However, for various institutional reasons which are historically and socially situated, developing these inter-system compatibilities is difficult to achieve in practice, and also theoretically complex to understand. With this background, this thesis addresses the following two research questions:

- How can the relationship between decentralization of health systems and the HIS, and sustainability of HISs be theoretically better understood?
- How can decentralization processes be conducted in a way that better enables the development of sustainable HISs?

These research questions are addressed through interpretive case studies in two health districts in Tanzania. The practical motivation to undertake this study came out of challenges initially encountered when trying to adapt the Health Information System Program (HISP) in these health districts during the period from 2002 to 2005. HISP<sup>1</sup> is a research initiative and development network on health information systems in developing countries initiated by the University of Oslo. It was started in South Africa in 1994 (Braa & Hedberg, 2002) and subsequently extended to Tanzania in 2002. The partners of HISP in Tanzania (the University of Oslo, the University of Dar es Salaam, and the Ministry of Health (MoH)) signed a memorandum of understanding (MoU) in 2002 for a pilot implementation of HISP in two selected districts, namely Kibaha and Bagamoyo in the Coast region. HISP was established with the aim to strengthen and further develop the local HIS through training, capacity building, and the design, development and implementation of free and open source software called the District Health Information Software (DHIS). The empirical work was framed within an action research framework using participatory approaches to support local management of health care delivery and information flow (Braa, Monteiro & Sahay, 2004).

While working at the health districts and facilities, some efforts were directed towards changing the performance of the existing paper based HIS, bearing in mind that success of the HISP approaches

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<sup>1</sup> HISP aims to support health management and decentralization structures in developing countries including Tanzania. It also includes the introduction of computer-based health information systems to empower local users to have a greater control of their own health information. Braa, J. Monteiro, E., and Sahay, S. (2004). Network of Action, In. MIS quarterly 28 (3): 1-26. See also. [www.hisp.org](http://www.hisp.org) and [www.hisp.info](http://www.hisp.info)

and associated technologies depended very much on the existing paper based HIS – the historical legacy system. These efforts involved the introduction of new computer based information systems, various training programs, and discussions and negotiations with different individuals and officials from local and higher levels (districts, regions, national level) representing multiple health programs. Thus, the empirical basis of the research in this thesis is provided through an ongoing research study of the design, implementation and use of the HIS in Tanzania. In this study, data comes from two sets of analysis processes. First, a study of the existing HIS across different programs and levels and second, a study of an on-going effort aimed at introducing a new computer system based on the HISP initiative (Braa, Monteiro & Sahay, 2004).

This study in this thesis is based on an interpretive research approach which assumes that reality is socially constructed and knowledge of it is accessed by studying processes around language and the development of shared meanings (Walsham, 1993). The approach emphasizes the role of action and the agent, and the dynamics by which they mutually constitute and are constructed (Walsham, 1995a & 1995b). As a member of the HISP team in Tanzania since 2002, I had the opportunity to work closely with the pilot health districts and make detailed observations of the work settings between and within different organizational levels. Within the HISP action research framework, I visited several districts and health facilities over time and participated in training seminars and workshops, formal and informal meetings, and conducted several interviews with key actors involved in the health sector. This long term exposure helped me to develop a deep understanding of the problem domain and to make my research questions very focused. Specifically, for the purpose of this study, I selected two health districts namely, Bagamoyo and Kibaha situated in the Coast region. Both rural districts have been HISP pilot sites since 2002. Focusing on these two pilot districts, I performed an in-depth analysis of the practices surrounding the HIS (data collection, information and computer use, supervision, the flow of data and resources between levels) and their inter-relationships with other systems (health, administrative and political administration). Simultaneously, I was involved in various interventions related to the customization and implementation of the new systems. Through the use of an interpretive lens, I have attempted to analyze some key aspects of the introduction of computer based HISs and their relationships with processes of decentralization.

This chapter is further organized into four sections. In the following section, I provide a brief overview of the concepts of decentralization and sustainability - the founding blocks of this thesis. This section will also discuss the relationships between these two concepts. In the subsequent section, I explain various concepts drawn from both the information infrastructure perspective and institutional theory that are used to analyze the institutional and infrastructural aspects shaping the decentralization and sustainability of the HIS. These discussions lead us to the next section where I outline the expected contributions of the study. Finally, I present the organization and structure of the thesis.



## **1.2 Related Research on Decentralization and Sustainability**

In this section, I describe two concepts that are central to this thesis, that of decentralization from the perspective of both public health and IS, and sustainability. This then provides the analytical basis to examine the issue of their inter-relationships, and their implications for HIS.

### **1.2.1 Decentralization of Health Systems**

In the second half of 1980s, most African countries started to transfer power, resources, and responsibilities to their sub national governments (Brosio, 2000). The pace of transformation, though uneven across countries, was largely pushed by international agencies and national and regional governments requiring increased autonomy and a more equitable distribution of resources. The decentralization efforts were accompanied by the formulation of various reform policies, laws, and legislations (Litvack et al. 1998). Decentralization policies are concerned with changing power relationships between organizational or governmental levels, and are a response to the past failures and inadequacies of centralized bureaucracies to effectively provide health for all and redress the marginalization of rural communities (Brosio, 2000). Decentralization through increased community/local level participation are expected to contribute to a more effective and equitable provisioning of health services (Görge et al., 2004).

Initiatives towards the decentralization of health systems were shaped by both external and internal forces (World Bank, 1987; World Bank, 1997), in particular donor communities (WHO, 1978). These initiatives aimed at accessing efficiency gains by incorporating local information in decision making and removing layers of bureaucracy (World Bank, 1987). These motivations are primarily embedded in economic and social rationales of improved efficiency and enhanced equity, accessibility, responsiveness, and quality of local health services delivery to large populations (Hutchinson & LaFond, 2004; Litvack et al., 1998; Galvin & Habib, 2003). These potential gains are also associated with various constraints (Mills, 1990) depending on existing cultural, historical and institutional factors.

Decentralization of health services emphasizes the need for health services to be managed in small community groups, enabling local understanding of health problems, and acting upon them in a participatory and locally relevant manner. The assumption is that with decentralization, operational subunits (health districts) can help to increase quality and bring about various efficiency gains. For example, financial planning could be more sound if it were based on clearer information about resources required locally (e.g. staff, drugs, transport, renovation work, etc.) which is more easily available at the local level as compared to at the central level, thus the argument that such planning should be decentralized. This makes planning exercises more relevant and responsive to local needs, thereby strengthening the sustainability of the improvements (Görge et al., 2004).

Decentralization involves the transfer of authority and responsibility in planning, management and decision-making from the central to the lower levels of organizational/governmental control (Saltman et al. 2004; Mills, 1990). In the context of the health sector, this implies that the district and

sub-district levels are expected to be given greater responsibility and control over resources and that the role of the central level (Ministry of Health) is to be limited to developing necessary policies, strategies, priorities, standards and an enabling environment in which the local levels can operate effectively on the ground (Görge et al., 2004).

However, decentralization is a very complex process as it transcends various political, fiscal, and administrative boundaries. Three forms of decentralization – de-concentration, devolution and delegation (Litvack et al., 1998; Görge et al. 2004; Mills, 1990) relevant to this thesis are briefly described:

- De-concentration refers to the transfer of administrative rather than political authority by establishing additional management levels at the decentralized levels to perform certain administrative functions.
- Devolution refers to the transfer of important decision-making powers (political and fiscal) and administrative functions to decentralized levels making them semi-autonomous and largely independent of the national level.
- Delegation refers to the transfer of managerial responsibilities for defined functions to independent organizations that are external but accountable to the central government.

Certain government functions can be devolved while others only de-concentrated, implying that a country can have both features of devolution and de-concentration (Mills, 1990). Devolution is described as the ‘true’ form of decentralization in which sub-national levels of government are given complete authority for specific public services which were previously provided by the central government (Parry, 1997). Devolution is advocated by most donors and adopted by the national governments of various developing countries (Galvin & Habib, 2003) including Tanzania. In the health sector, devolution involves the transfer of decision making authority and responsibility for the administration of PHC services to local levels including the district administration or municipalities. Administratively, the head of the district administration is usually appointed by the central government, whereas the members of the district council (a political administrative body) are usually elected representatives of the community.

Depending on the degree of decentralization, the district council may be wholly or partially responsible for the provision of health care in the district. Within such an administrative structure most African countries also have a regional or provincial level which consists of several districts. Formerly, the regional administration was superior to the district council in all matters, but gradually during the course of decentralization, the district level has been granted significant decision making authority. However, the regional level retains a major role in the implementation of national health policy such as the development of priorities, quality control as well as coordination and support of the districts (the regional level however is not independently responsible for the budget). While strong districts are unquestionably an important element of decentralization, some tasks are arguably more effectively managed at the regional level, such as the management of epidemics like HIV/AIDS which may not respect district boundaries.

The district health system is responsible for providing primary health care services, both curative and preventive, in line with national health policy and to respond to the health problems and needs of the local population. In addition, the district health management body plans and budgets for the activities needed to provide both primary (health centers and dispensaries) and secondary (first referral hospitals) health services. Generally, there is an official district hospital, and sometimes there are also smaller, mostly non-governmental hospitals. However, the system is also comprised of village and community-level activities as well as vertical programs, thus rendering the overall structure significantly more complicated and complex.

Despite the expected benefits of decentralization, these are not easily achieved due to existing technical, political, and administrative conditions (Görge et al., 2004). Consequently, local authorities continue to rely on central government, contributing to a dilution of local autonomy (Mills, 1990). Decentralization efforts are shaped by various impediments including local government's lack of technical ability and resources, the weak political will of the central level to relinquish their decision-making authority and financial and political influence (Galvin & Habib, 2003), and the central levels skepticism about the technical capacity of local administrators. (Mills, 1990; Gideon, 2001). As a result, originally intended devolution reform efforts can end up as de-concentration reform (Mills, 1990), raising the need for training and education for both local and national level administrators.

Many of the constraints related to decentralization have been attempted to be addressed through the formulation of new policies and regulations that outline the relationships among different levels, and groups of actors. Litvack et al. (1998, p.26) have argued that it is unproductive and misleading to debate whether decentralization is "good" or "bad" since its effectiveness lies in its design, and varies greatly in form within and among countries. Several conditions are necessary for successful implementation of decentralization, including the suitability of the new regulations and resources, the speed of implementation, and the associated capacity of human resources. The competence and the commitment of the local and central government to help in the training of staff affected at different levels are also important to the success of decentralization (Görge et al., 2004).

Thus, decentralization is about building local capacity – the ability to set goals, anticipate needs, make informed decisions, and manage resources so as to meet those goals (Parry, 1997; Rondinelli, McCullough & Johnson, 1989). Successful decentralization requires support and promotion of local capacity. These conditions depend on political, cultural, organizational and financial factors (Rondinelli, McCullough & Johnson, 1989). The local capacity is built through the development of human and financial resources, which are most often at a premium in most local governments in developing countries. Decentralization also requires the creation of appropriate mechanisms by which the central government continues to support the decentralized entity technically and financially in order to develop sufficient local capacity. This capacity building must be a gradual and closely monitored process as the decentralization process requires not only the development of new institutions but also a change in the attitudes, behaviors and work functions of those in both the central

and decentralized organization (Parry, 1997). According to Samoff, “decentralization is effective only when it is compatible with the interests of those expected to implement and defend it” (Samoff, 1990, p. 523).

### **1.2.2 Decentralization of HIS**

While there have been on-going efforts to decentralize health systems in developing countries, the Human Development Report released in 2004 (HDR, 2004) underlines that the majority of the population in developing countries are facing high disease burdens and have limited access to primary health services. Consequently, efforts to decentralize health systems are going on in parallel with the implementation of HISs, including the building of local capacity to effectively use health information (Pappaioanou, 2003), including both health services and epidemiological data. Some data is gathered routinely (from reports and registers) for monitoring purposes, while other data is gathered through focused surveys at larger time intervals (e.g. every 2 – 3 years). The health indicator is measured by establishing the percentage of people in a target group who are actual users of a service in relation to the number of people who should be using the service. For example, the total number of children under one year who have received all the necessary vaccinations (e.g. polio, measles, tuberculosis) as a percentage of the total number of children under one year in a given geographic population.

According to the World Health Report (2004) and WHO (2004) there is a need to strengthen management and information use practices for local action in order to better support health interventions and improve access to health services. ICTs are also commonly implicated in decentralization of HISs as a tool to further strengthen the HISs (Lippeveld et al. 2000; Braa & Blobel, 2003). ICTs are viewed as having the potential to strengthen the HIS by facilitating the decentralized collection, analysis, reporting, presentation, and use of data. The local processing of data and use of information are considered important processes to strengthen the management of the PHC at the local level.

Various researchers (Braa, 1996; Walsham, 1992) have argued for the need to design locally relevant/decentralized HISs different from the historical top down/centralized systems. Centralization refers to the allocation of IS/IT resources to one particular organizational level or unit that provides IS/IT services to the whole organization (Gordon and Gordon, 2000) involving centralized control (Robson, 1997) to enforce standardization. However, centralized systems tend to be bureaucratic and inflexible in nature (Robson, 1997) since they cannot be easily localized to support individual units or organizational levels. In addition, since users at the individual units are typically only marginally involved with the system, they often tend to feel less responsibility (Ahituv, Neumann & Riley, 1994), and express limited satisfaction and motivation (Walsham, 1992).

In a decentralized organization, control and coordination of the system is delegated to the various organizational sub-units (Ahituv, Neumann & Riley, 1994), thus providing them with a degree of autonomy (and associated accountability) over various aspects of their systems (Gordon & Gordon, 2000), including budgets and the use of resources (Ahituv, Neumann & Riley, 1994). Such autonomy

imparts a degree of flexibility and a sense of empowerment of the individual units. The goal of the decentralized system is to meet the needs of the individual unit by granting them local control of the system, potentially making the system more locally responsive and with the capacity of motivating the staff (Robson, 1997). Decentralization thus offers benefits of increased accountability of the individual units and an associated decrease in bureaucracy (Earl, Edwards & Feeny, 1996). The main disadvantage of decentralized systems is that by their very nature, they lack centralized control (Kroenke & Hatch, 1994), often resulting in contradictions and conflicts between central and local levels over various issues, and presenting difficulties in standardization, integration and optimal sharing of resources. These contradictions and conflicts can lead to inefficiencies and delays and thus the unsustainability of the system.

According to Walsham (1992), the IS design and implementation approach in most developing countries tends to follow a top-down organizational structure where the central level determines information required at the local levels. Usually there is limited participation of the staff at the peripheral levels except for data collection and entry. As a result, this staff often views the IS merely as a burden and as a means for central control. In contrast to this approach, Walsham (1992) suggests a “bottom up” design approach that reflects a decentralized organizational structure, where the local level staff perform their own activities in addition to providing information required for the higher level. Such an approach involves training, continuous learning from local experience and emergent changes to modify and improve the system over time thus ensuring its sustainability. Kling and Scacchi (1982) argue that participants in different work units or groups have different computing preferences linked to their own areas of work and that their political acceptance of information systems is higher when they see that the IS is aligned to their own interests and needs for control (Kling & Iacono, 1984).

Braa & Hedberg (2002) present a relatively successful story of the “bottom up” development of the decentralized HIS in South Africa under the HISP initiative. The initial donor funded HIS was developed in 1994 from a local, bottom up, grassroots movement from three pilot districts in Cape Town. This system slowly evolved to become the national standard and is still being used in South Africa today. The development process was described to be in line with the then ongoing processes of reforms in the political, social and health policy spheres (Williamson et al., 2001) aiming to build a “new” South Africa” free of apartheid. According to Braa & Hedberg (2002), the failure of other projects, largely characterized by their centralized nature, contributed to the relative success of the HISP. However, the historical conditions prevailing at the time of the initiation of the HISP in South Africa will probably not exist in other countries, thus requiring different strategies and approaches to decentralization.

The importance of the bottom up approach is that it creates a sense of ownership and leads the development of a flexible system (Braa & Hedberg, 2002) enabled through participation (Puri, 2003) and mutual learning. Flexibility is inscribed into an evolutionary systems development process as it makes it possible to integrate changes over time at both the institutional (work processes and rules)

and technical levels (Braa, 1996). Given the complex nature of a health care organization, such an evolutionary approach tends to be most successful since it allows large scale and emergent changes.

Decentralization of HIS needs to be synchronized with that of the health care system involving the PHC structure, since HIS provides the ‘glue’ that holds the health systems together. However, health policies do not explicitly state and address these two sets of decentralization processes in an integrated manner. The health system is composed of different levels which have different data requirements. At the community level, information is needed for clinical management, health service management and assessment. At the district level, health information is needed by health planners and managers to take decisions regarding the tasks of the health facilities and resource allocation. The lower level of the system is where detailed and large amounts of data are required in order to provide care for individuals and populations (AbouZahr & Boerma, 2005). By its nature, the HIS is a decentralized system since it is constituted in a decentralized organizational structure (Gray, 1986) with diverse procedures, information needs, tools for data collection, and institutional contexts.

Although there are on-going processes of decentralization of decision making and resource allocation to the district level, the HIS remains at best only partially linked to these elements. For example, the human resources capacity for information analysis and use and the required tools tend to be concentrated centrally, at the national level (Lippeveld, 2001; AbouZahr & Boerma, 2005). The data collected based on patient/client encounters in the health facility or through community outreach is compiled and transmitted to the district and all the way through to the regional and national levels. The lower levels of the system have no control of the HIS facilities and resources critical to their effectiveness, for example, data collection tools. The lack of flexibility makes it difficult to accommodate the needs of the individual levels in the HIS over time. Consequently, the HIS produces unsatisfactory information for planning and lacks relevant information to use as a basis for local action (WHO, 1994).

Decentralization involves the creation of a culture where information is valued for how it supports local action, not just for how it meets the reporting needs of a centralized bureaucracy. As Williamson et al. (2001) argue:

*...A culture of information [means] information is actively used for resource allocation, planning[at local level] and policy development at higher levels... implementation of an action-led district information system [requires] establishing a culture of local analysis and use of information in order to identify and follow progress towards local targets within a primary health care approach.... [But] reality has indicated that managers seldom seek information and once given it, are at a loss as to how to deal with it. Thus training also needs to include supporting the managers who need to use the information (p. 774) [when] information is used for planning and daily management of health services, [it] is often referred to as existence of a local “information culture”. (p. 776).*

In summary, decentralization is the process where a central government relinquishes some of its administrative and management responsibilities or powers to a local government that is closer to the

point of service or action. In the context of the health sector, decentralization refers the transfer of decision-making, planning (political), budgeting (financial), management, and resource allocation (administrative) of health systems from the national to the district and sub-district levels (Mills, 1990). In this thesis, the focus is on analyzing the two sets of processes related to decentralization of health services delivery and HIS and their inter-linkages, with a particular focus on the routine HIS. Typically, the health systems and health information systems (HISs) are mutually inter-dependent. However, efforts to implement the HISs are not adequately aligned with similar processes of decentralization of the health system. For example, there is a lack of use of information from the HIS for district health planning and decision making (Mwangu, 2003). Consequently, the ongoing efforts of decentralization of health services lack appropriate information on the health status of the local population. Although, the local health management body is responsible for the supervision and monitoring of all district based health services, the HIS remains centrally controlled in terms of its design and implementation, allocation of resources, training, and support. The ICT based HIS is therefore introduced to replace existing paper records but under extreme time pressure and with a lack of sufficient resources, training and administrative support. The HIS thus operates in a top-down and hierarchical fashion with limited capacity and resources to manage it and use information locally. The lack of integration of the two sets of processes of decentralization, contributes to the unsustainability of systems.

### **1.2.3 Sustainability of HIS**

Braa, Monteiro & Sahay (2004) have argued that it is necessary to take the issue of sustainability seriously if effective HISs are to be developed in developing countries. Sustainability relates to the challenge of institutionalizing systems in a practical setting. The HIS is institutionalized if it is integrated into organizational routines (Kimaro & Nhampossa, 2005). For example creating roles, responsibilities, structures, and budgets to support and manage the HIS over time. Institutionalized features of the HIS become absorbed and integrated into the various organizations and become normal and routine because of their legitimacy. A sustainable HIS must be institutionalized (i.e., become routinized into the every day working of the local organization) and maintain its benefits over time (Manfred et al. 2001; Puska et al., 1996).

However, not every system that gets institutionalized at the local level can be described as useful and sustainable. For some reason, ineffective systems can also become institutionalized (Kimaro and Nhampossa, 2005). The sustainability of a system is dependent upon the degree of its demand and use, its appropriateness to the organization and its users, and the availability of adequate local capacity and resources to sustain benefits achieved over time (Akubue, 2000; Oyomno, 1996). Moreover, for a system to remain sustainable over the long run, it must possess the required flexibility to be adapted to the changing needs of the organization over time, and the organization must have adequate local human capacity and resources to translate changing needs to system design and development efforts.

Heeks (2002) has described sustainability failure or unsustainability of the system as a system that succeeds initially but fails to deliver the required benefits over time. He (Heeks 2002) identifies various risks that contribute to the unsustainability or failure of systems including the hierarchical and centralized nature of organizations, lack of information culture, lack of physical infrastructure, IT illiteracy and lack of systems development skills, and unstable political environments and work processes. A system becomes unsustainable when it is not fully institutionalized and when it is not flexible enough to accommodate new changes. A variety of reasons are associated with this situation. The ICT based system in question may be based on the work and advice of non-experienced ICT professionals and developers often taking advantage of lack of capacity at the local level. Consequently, ICT based systems tend to have little impact on the organizational weakness as they were intended to alleviate (Sahay & Avgerou, 2002). ICT based systems may also be implemented following the power and interests of central level officials (Walsham, 1992), thus failing to reflect the actual work practices and needs of the local organization where they are expected to be used, leading to limited local benefits. Moreover, the rigid nature of many ICT systems can make it difficult for organizations to develop the system further to incorporate emerging services and needs (Kimaro & Nhampossa, 2005) at both a technical and institutional level. For example, the lack of flexibility to add new services and limited ability to analyze data based on local level needs. A centralized system also often leads to a lack of local motivation and capacity and an absence of resources to ensure that the system is sustained locally and further strengthened over time.

Addressing the local sustainability of HISs therefore involves critical consideration of issues of institutionalization, flexibility and decentralization and around the technology and inherent socio-institutional complexity in which the system is embedded. The alignment of the HISs with the health services delivery system can facilitate institutionalization of the HISs into the day-to-day activities of the provision of health services thus partly contributing to its sustainability. In this sense, the new meanings, structures, rules and norms associated with the HISs are institutionalized into the system of the day-to-day provision and management of health services. Decentralization of the HIS involves both technical and institutional features associated with the HISs. The HISs need to be institutionalized in the local practical setting, meaning that it is owned by the peripheral staff, it supports their on going day-to-day activities and it relies on locally available resources.

In summary, decentralization implies the transfer of authority for decision making and planning of the HIS from the central level to the local level as well as local capacity building to sustain the HIS. The aim is to “grow” the HIS at the local level through institutionalization of the HIS and through the building of local capacity to guarantee limited dependency on the central level. Decentralization of the HISs cannot be done by imposing new behaviors, rules, values and norms (Alvesson, 2002; Keen, 1981). Thus, in the absence of decentralization of the HIS, it may difficult to mobilize resources and develop local capacity to sustain the system, for example, to provide timely maintenance, regular training and to cope with dynamic local needs. In this thesis, sustainability is considered to be achieved when systems are blended in such a way so as to be both institutionalized and have the



flexibility and capacity to evolve with the changing needs of the organization. The decentralization and local sustainability of the HIS is therefore inter-linked, thus this thesis proposes a combined perspective – decentralization and sustainability – as the guiding lens for implementation of HISs.

#### **1.2.4 The Decentralization and Sustainability relationship**

Despite the benefits of decentralization of HISs for local sustainability, sustainability of HISs is very complex to achieve in practice. The relationship between decentralization and sustainability is complex as it is embedded in various kinds of infrastructures and institutions. Several infrastructural and institutional aspects need to be considered such as flexibility of the HIS, formal rules of the HIS, the local informal norms (such as traditions, customs and values), and the political and administrative commitment in which the HIS is embedded. All of these elements can impact the HIS and its sustainability. For example, central control of the HIS often results in issues related to local flexibility. Although a HIS may be decentralized, flexibility of the HIS remains an important factor for its local sustainability. Flexibility, however, has its consequences in that it can lead to multiple standards or versions of the HIS, affecting overall coordination and supervision practices around the HIS from higher levels. Thus, the HIS only needs a certain agreed level of flexibility that can allow the local level to deal with dynamic needs and changes. Typically, with a large system such as a HIS, it is impossible to foresee all relevant technical and institutional issues or problems. Some of the issues or requirements are discovered or realized as the development/implementation process goes along, forcing the system to be changed and tested further. Thus, it is most beneficial if flexibility can be embedded in the design of the system. However, there are different types of flexibility, for example change flexibility refers to a system that is easy to customize or replace and use flexibility refers to a system that is multipurpose (Hanseth, 2002; Hanseth, Monteiro, & Hatling, 1996).

Realizing the importance and consequences of the aspect of flexibility, Braa & Hedberg (2002) have proposed a so called “principle of a hierarchy of standards” that can be used to balance local flexibility and multiple levels of control of the HIS. This approach gives the hierarchical levels the freedom to define their information needs (such as data sets and indicators as an extension of standard data sets at the level above) as long as they align with the set of agreed standards. Also, associated information technologies (ITs) are designed to be as flexible as possible to support this hierarchy of standards. The flexible ITs are developed through a series of prototyping, evolutionary development (Braa, 1996), and participatory design (Schuler & Namioka, 1993) to allow for continuous learning, feedback and conflict resolution from the multiple levels of the health organizations. This approach is different from traditional software engineering approaches whereby the developer (while playing a leading role) specifies the entire system design, then develops the design as a software product, and finally puts this new product into use (installation and training) (Pressman, 1992). Thus, although, the decentralization and sustainability perspectives are inter-linked, understanding this relationship is complex as it is embedded in various kinds of infrastructures and institutions. Therefore, I have chosen to draw on the information infrastructure perspective and institutional theory.

### **1.3 Theoretical overview: Institutional Theory and Information Infrastructure perspective**

The concepts drawn from both the information infrastructure perspective and institutional theory are used to analyze the institutional and infrastructural aspects shaping the decentralization and sustainability of the HIS. The understanding developed is used to propose a theoretical framework to better understand the nature of the relationship between decentralization and sustainability. The institutional theory is important to explain various aspects of dominant institutions and their role in the change process associated with decentralization and sustainability efforts. However, the institutional theory under-theorizes technology artifacts, and thus there is a need for an additional perspective to provide insights into the infrastructures change. The institutional theory does not take the role of ICTs and other material artifacts in serving as institutional constraints (both formal and informal). The information infrastructure perspective is helpful to provide insights into how to change the institutional and technological installed base.

An Information Infrastructure is defined as a shared, evolving, open, and heterogeneous installed base (Hanseth & Monteiro, 1998b; Cibora et al., 2000; Hanseth & Monteiro, 1997). The concept of installed base refers to what already exists both technically and institutionally such as existing standards, ICTs, work practices, and organizational structures. The installed base is deeply embedded and institutionalized in existing routines, social structures and cultures. It cannot be changed instantly because of the degree of institutionalization of its constituent elements. A realistic strategy for its change is to take gradual and progressive steps to change the infrastructure through extensions and improvements of the existing installed base (Hanseth 2002; Hanseth & Monteiro, 1996). Thus, the existing installed base both technically and institutionally impacts the way in which new information infrastructure can be designed or developed. The development of a decentralized HIS characterizes an information infrastructure as it is constrained by the existing installed base comprising various infrastructures and entrenched institutions.

Various researchers have employed institutional theory in a variety of disciplines such as in social science (economics, sociology and political science) and organizational studies. These vary in the way they emphasize cognitive and normative aspects of institutions and rational networks in the creation and change of institutions (DiMaggio & Powell, 1991b, p.1). Economists and political scientists emphasize the regulative view of institutions (Scott, 1995). North (1990), a social economist, defines institutions as the "rules of the game," consisting of both formal rules (such as the constitution) and informal norms (such as traditions, customs, values, norms of behavior) that govern individual behavior and social interactions in organizations. Organizations such as agencies and firms, by contrast, are the structural mechanisms which utilize, alter, and enforce institutions.

The "new institutionalism" (March & Olsen, 1989; DiMaggio & Powell, 1991b; Giddens, 1984) emphasizes that social context shapes social action, which in turn shapes social context. It emphasizes the cognitive basis of how individuals perceive or interpret data within the frames of meaning underlying their interpretive processes (Scott, 1995). Barley (1990) defines institutions as "sets of

overarching principles and practices that have a normative force of taken for granted assumptions or cultural blueprints for action” (p. 64). However, according to Scott (1995 & 2001), both normative and cognitive analyses are needed to provide a complete explanation of institutional behavior. Institutions are thus, according to Scott (1995 & 2001), multifaceted systems consisting of varying degrees of cognitive systems, normative rules, and regulative processes carried out through and shaping social behavior.

An institutional perspective has been applied to study a variety of fields. In IS, it has been applied by various scholars, for example, to study how institutions influence the design, use and impact of ICTs in organizations. Orlikowski & Barley (2001 p.153) argue that institutional analysis can be used to examine “how broad social and historical forces, ranging from explicit laws to explicit cultural understandings, affect and are affected by the actions of organizations”. They further state that “to include insight from institutional theory, IT researchers might develop a more structural and systematic understanding for how technologies are embedded in complex interdependent social, economic and political networks, and how they are consequently shaped by such broader institutional influences” (ibid, p.154). Walsham (1993) has argued that computer based systems embody interpretive schemes and encapsulate norms which are drawn on in social action. Their development process involves the use of rules, beliefs, commitments, and assumptions of the existing social system, for example, types of information needed and collected, reporting frequencies and format, languages used, and the manner in which the user interface is customized. Thus, technologies are regarded as both technical and social artifacts (Orlikowski & Barley, 2001) having institutionalized values, norms and rules (Lines, Andersen, & Monteiro, 2003).

Volkow (2003), using institutional analysis of a case study of the state owned Mexican Oil Company, explored how local social values and historical conditions shaped the use of ICT and the impact of ICT use on the social environment and organizational change. Similarly, Lines, Andersen and Monteiro (2003) have analyzed the adoption of ICT based system in the Norwegian public health sector, focusing on the socio-technical processes of negotiation of actors involved. They found that the process of the introduction of the new ICT based system was always in competition with institutionalized practices, interests and norms. Moreover, Madon et al. (2004) have described how property taxes are assessed in Bangalore, India, showing how personal relationships between tax collectors and property owners are the basis for assessing property taxes rather than formal principles, thereby illustrating the impact and dominance of informal constraints over the formal rules.

Health care organizations incorporate institutions as they encompass formal rules and informal constraints. Institutions are articulated and expressed, through work structures, control mechanisms, reward systems and ownership. People operating within HIS interact and respond to each other through formal rules or culturally shared behavior (informal constraints) without having to negotiate ground rules (North, 1990). Both the government and the health sector make and enforce rules and laws regarding the delivery of health delivery and both create and regulate various aspects of how health staff can provide health care services including their rights, obligations and duties.

Centralization of the HIS is the process by which the activities, decision making, and resources associated with the HIS become concentrated within a central level. As a result, the local level is connected vertically to the central level that provides critical resources and formal rules for the functioning of the HIS. Thus, while the vertical patterns are rationally constructed and hierarchically arranged, locally oriented patterns tend to be informally structured (Scott & Meyer, 1991). The lack of overlap between the formal and the informal constraints could potentially make the HIS ineffective (Madon et al., 2004) and unsustainable.

Scott & Meyer (1994) define institutionalization as the “process by which a given set of units and a pattern of activities come to be normatively and cognitively held in place, and practically taken for granted as lawful whether as a matter of formal law, custom or knowledge” (p. 10). Thus, the concept of institutionalization is widely used to denote the process of making a concept, a social role, particular values and norms, or modes of behavior become embedded within an organization or social system as an established custom or norm within that system. In the context of decentralization, the individuals, values and norms associated with a HIS may become institutionalized through established supportive structures, developed meanings, and routines. Institutionalization, therefore, is an important element of the management of organizational culture and important in relation to issues of organizational change. Institutionalization can also be seen as being an important part of the process of decentralization, involving the expansion and improved organization of the structures and practices of the HIS such that they become routines at the local level. The system is incrementally developed and implemented over several years through processes of institutionalization. Over time, the organization and arrangement of the HIS become a “taken-for-granted” or routine way of managing and coordinating the delivery of health services. As the HIS is used over time, it becomes highly institutionalized reflecting both the degree of financial and ideological commitments incurred, which can make it difficult to radically change.

A HIS is not a stand-alone system, and in addition to being linked to various infrastructures and institutions, it is also part of a wider (political, cultural and administrative) environment that can influence its performance. Institutions operate in an environment consisting of other institutions. The HIS is influenced by various institutions from a variety of entities as well as their linkage referred to as an organizational field. Avgerou (2002) writes:

*An organizational field is understood to be constituted by organizational actors competing in the production of similar products or services ... consumers and regulatory agents. The participant in an organizational field may be located in the same geographic location or dispersed. Apart from the technical exchanges among them, such as contract based or financial transactions, they exert normative or cognitive influences upon each other, sharing similar sets of activities...* (p. 38)

The existing weak linkages between these entities, coupled with the inherent contradictions between them contribute to create a gap between the formal rules and informal constraints. This lack of overlap between the formal rules and informal constraints can potentially make the HIS ineffective

(Madon et al., 2004) and provides various contradictions to the process of decentralization. Some contradictions arise because of the imposed formal rules, making it difficult for them to be interpreted and understood similarly by individuals at different levels (Piotti et al., 2006). Consequently, the acceptance and enforcement of such top down practices at lower levels are in practice difficult. Thus different institutional influences from the multiple levels and various entities comprising the organizational field often contradict each other (Jepperson, 1991), thereby affecting the process of both decentralization and local sustainability.

The institutional and infrastructural nature of the HIS suggests the need for an appropriate approach to develop and implement a decentralized HIS. The traditional life cycle IS development models have several limitations and as a result, various approaches have been suggested to overcome them. For example, the “improvisation” approach suggested by Ciborra (1996) and Orlikowski (1996), in which they both view IS development and implementation as a part of organization change. In this approach, IS development and implementation is viewed as an ongoing process since not all changes and needs can be anticipated beforehand. On the other hand, Porra (1999) has proposed focusing on how history plays an active role in terms of how past experiences shape future actions. Hanseth (2002) argues that these assumptions about IS development and implementation are also crucial for information infrastructure development but are not exhaustive. He argues for more focus on both the dynamic of the change process and the role of existing ICTs. Hanseth (2002) has also proposed an alternative approach, initially discussed by Dahlbom & Janlert (1996) called “cultivation”. Dahlbom & Janlert (1996) argue that with cultivation, “we interfere with, support and control, a natural process” ...” the tomatoes themselves must grow, just as the wound itself must heal.” (ibid, p. 6-7). In this thesis, I argue that the concept of cultivation is very important for sustainability of the system in the sense that rather than focusing on the limits of rational and developer (external)/centralized control of the system, it relies on local, self-reinforcing change mechanisms related to the technical and institutional aspects of the system. This ensures that there is learning, ownership, planning for resources and training of the system, and thus that the system is locally sustainable. The cultivation approach is based on an iterative and incremental strategy due to the existing difficulties to rapidly change highly institutionalized practices, structures, norms (Hanseth, 2002; Hanseth & Aanestad, 2003) and legacy systems.

#### **1.4 Expected contributions**

This thesis aims to contribute to the theoretical domains of IS and Public Health field. The study is also aimed at developing practical implications for public health/ICT professionals engaged in management and/or introduction of ICT based IS in developing countries, specifically in the Tanzanian context.

##### **1.4.1 Theoretical**

This thesis aims to contribute primarily to the fields of Information Systems (IS) and Public Health. The two key contributions expected are:

- Developing a perspective to analyze the relationship between decentralization of health systems and HISs, and the sustainability of HISs;
- Contributing to debates around “sustainability” and “decentralization” in the contexts of public health and IS.

#### **1.4.2 Practical**

This thesis aims to develop practical implications for public health/ICT professionals working in the local settings of health care organizations in developing countries, specifically in the context of Tanzania. The practical contribution emerging from this research includes the following:

- Developing practical guidelines on decentralization of HISs that emphasize being sensitive to local sustainability.

#### **1.5 Structure of the thesis**

In this introductory chapter, I have presented the research topic, motivation and research questions as well as theoretical overview, expected contributions. The rest of the thesis is organized in the following manner. An overview of the national, organizational, socio-historic, and political context of the case study will be given in Chapter 2. In chapter 3, I present the theoretical framework to help analyze the interrelationship between processes of decentralization and sustainability of HISs. In chapter 4, I summarize the research approach adopted for the collection and analysis of empirical data, grounded in an interpretive tradition. In chapter 5, I briefly provide an overview of the research findings from the eight (8) research papers included in the appendixes to this thesis. The theoretical and practical contributions of the research are presented in Chapter 6, followed by concluding remarks of this research in Chapter 7.

## CHAPTER 2

### ***EMPIRICAL SETTING: THE TANZANIAN CONTEXT***

This chapter is organized into six broad sections. In the first section, the socio-historic, economic and political context is described to provide an overall understanding of the background of the country and its health sector. Section two is divided into four subsections within which I outline how this contextual background shapes the health sector. In sections four and five, I describe the current structure of the existing HIS and the opportunities and challenges in introducing the new computer-based HIS. In the subsequent section, I describe the introduction of the HISP and its activities in Tanzania. In the last section, I provide the summary of the country's profile, health sector and status of HIS.

#### ***2.1 Socio-historic, economic, and political context***

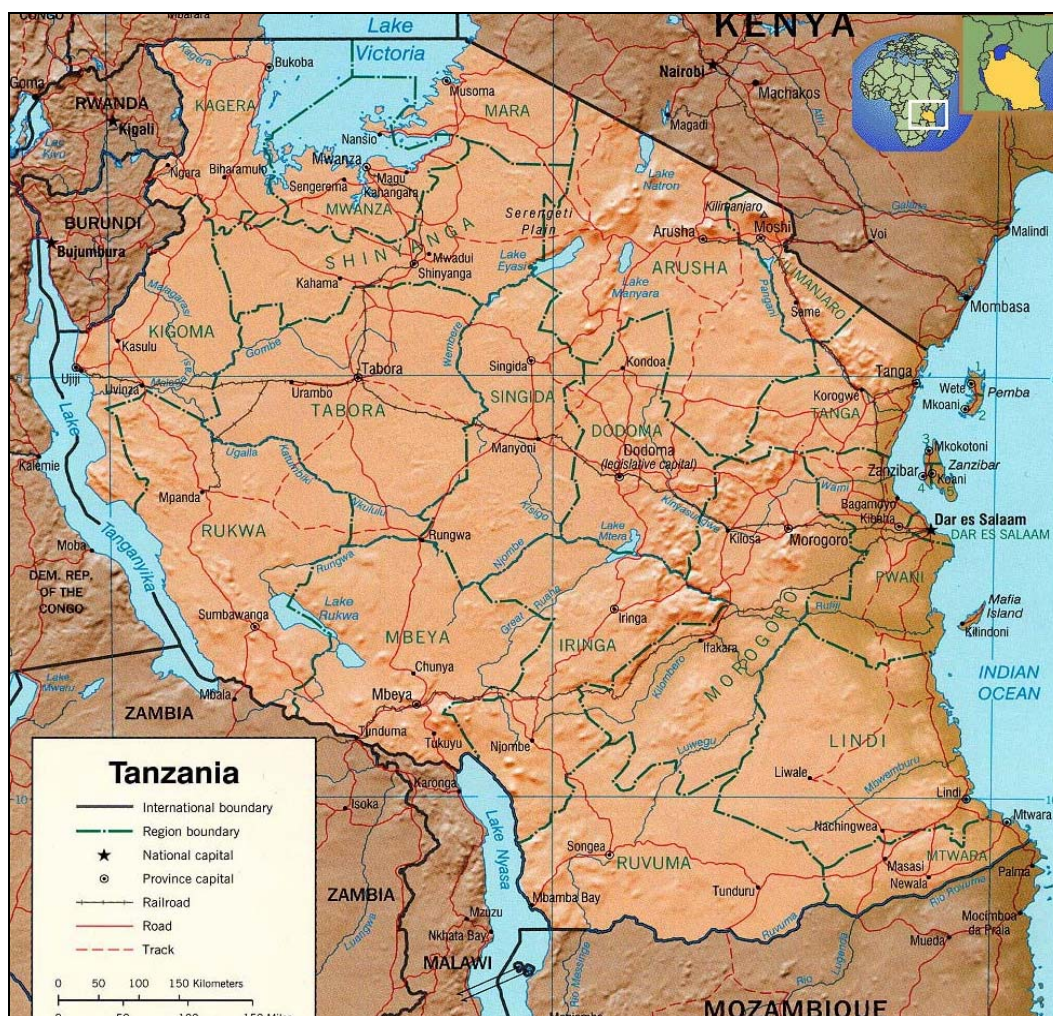
The Tanzanian mainland, previously Tanganyika, was part of the German East Africa during 1890-1918. However, in the mandate agreement of 1922, the United Nations accorded Britain the right to administration in Tanganyika. The mainland territory (republic of Tanganyika) gained independence in 1961 from British rule and was united with Zanzibar in 1964 to make up the United Republic of Tanzania.

Tanzania is situated in East Africa, immediately south of the Equator. Mainland Tanzania is bordered on the south by Mozambique, Malawi, and Zambia; on the west by Congo (Kinshasa), Burundi, and Rwanda; on the north by Uganda and Kenya; and on the east by the Indian Ocean. Lake Nyasa forms part of the southern boundary, Lake Tanganyika forms part of the western boundary, and Lake Victoria the northern boundary. Dar es Salaam is the former capital and largest city of the republic. The legislative offices moved to the new planned capital of Dodoma in 1996, but many government offices remained temporarily in Dar es Salaam. Figure 2.1 shows Tanzania and its location in the Africa continent.

According to the Tanzania population census of 2002, the population of the Tanzanian Mainland was 33,584,607 (16,427,702 – males and 17,156,905 - females) and Zanzibar was 984,625 (482,619- males, 502,006-females). The annual population growth is 2.9 %. The majority of Tanzanians (over 75 %) live in rural areas and Tanzania's economy relies mainly on agriculture. The agricultural sector contributes between 75 to 80% of all export income. A small variety of precious minerals are also mined for export and local use such as diamonds and tanzanite. According to the World Bank statistics, Tanzania is ranked as a developing, low-income economy and in debt, with the per capita income in 2004 estimated to be at about US\$290. In November 2001, Tanzania was the fourth country to reach the Completion Point for debt relief under the enhanced Heavily Indebted Poor Country (HIPC) Initiative. Total debt service relief was estimated over time to be around US\$3 billion (World Bank's country Brief). 35.7 % of the Tanzanian population lives below the basic needs poverty line and 18.7% of the population lives below the national food poverty line (Lorenz & Mpemba, 2005).



The income poverty has implications for the access to health care and the food poverty has implications for the prevalence of malnutrition.



**Figure 2.1 Tanzania and its location in the Africa continent**

The administrative structure in Tanzania is theoretically decentralized. The country is governed by a president. At the national level, there is a central administration responsible for affairs common to both the mainland and Zanzibar; the latter also has its own administration. The country is divided into 21 regions on the mainland territory and 5 on the islands (in total 26 regions). Each region has its own administration. It is further divided into 117 districts that serve as the principal administrative units. Each District is subdivided into Divisions, Wards and Villages. A ward consists of at least three villages that have their own village councils.

Tanzania consists of over 120 different ethnic groups, which are identified by common names and have different languages and more or less exclusive territories. People in each tribe possess the heritage of a common culture, such as historical traditions, customs, values and beliefs, and tribal languages. Since its independence, Tanzania has promoted the use of Swahili as its national lingua franca, along with the use of English in schools and in government offices. Although, Swahili is widely used, English is important in trade, commerce, and higher learning. The teaching language in primary schools is Swahili (grades 1 to 7) while English is used in secondary schools (from 1 to 6) and



in higher learning. Besides vocational training schools and colleges, there are three public universities and several other private universities. Primary education is compulsory in Tanzania, although in some areas there are not enough schools to accommodate all of the available children. According to a World Bank study conducted in 1993, the literacy level in Tanzania is estimated to have declined from 85% achieved in the 1970s and 1980s to 68% during the early 1990s. This was likely due to a decline in the primary school gross enrolment rate from 93% in 1980 to 63% in 1990. However, the gross enrolment rate for primary schools has recently increased sharply from 58.8 % in 2000 to 88.5 % in 2003. This has been a result of the implementation of a new Five Year Primary Education Development Program (PEDP) during the financial year 2001/2002 made possible by extensive donor support (World Bank's Country Brief).

In reality, the transition rate from primary to secondary school is very low given the limited number of public secondary schools. Although the rate has improved in recent years because of the liberalization of secondary education and the establishment of non-government schools, the rate is still limited for poor and disadvantage groups. The majority of Tanzania's secondary schools are private, most of them owned by different churches, individuals, and NGOs. The Tanzanian education system is pyramid-shaped, meaning that the selection for higher level education from the lower levels is based on academic achievement and availability of positions in the schools. The quality of education is often affected by high enrolment rates, low morale of teachers, and the poor conditions of work, and scarcity of educational resources (Juntunen, 2001).

Tanzania committed itself to the path of socialism in 1967 by announcing the Arusha Declaration, a major policy statement that called for socialism and self-reliance. The ideas of socialism were institutionalized in the state and a single party system, and central focus was placed on the struggle against poverty, ignorance and disease. The Arusha Declaration also created a program of rural development policy called the "ujamaa" (family hood) villagization policy that involved the creation of cooperative farm villages. Factories and plantations were nationalized, and major investments were made in primary schools and health care. Only the state had the capacity to bring modernization by encouraging unity among people, industrialization, and development in agriculture.

In 1973, the "ujamaa" villagization policy was proclaimed to be more or less compulsory and millions of peasant families were moved to new village sites which were often unsuitable for productive farming. The economy deteriorated due to floods, droughts and the fall of prices of agricultural products in the World market, affecting national agricultural production and exports. As a result of the failure of the "ujamaa" villagization policy and the declined economic growth, Tanzania was forced to follow the guidelines of the World Bank in 1985. Among other changes, this meant political liberalization and the introduction of an economic recovery program involving cuts in government spending, a free market, and the encouragement of foreign investment. In 1992, the single party system constitution was amended to allow for opposition parties, with the first multi-party parliamentary election being held in October 1995.

The formation of health services in former Tanganyika was based on the colonial health system. The colonial system was geared towards servicing a small elite group, mainly colonial administrators and a few others. As a result of this, at independence in 1961, the health status of the majority of Tanzania's population was very poor (Kopoka, 2000). A large segment of Tanzania's population had only limited access to basic health services or no access at all. The few services available were located mainly in urban areas and were based on curative services. Once the extent of the health delivery problem was realized, Tanzania, under the leadership of the late Mwalimu Julius K. Nyerere, declared “disease” and “ill- health” as among the enemies of country’s social economic development.

Post independence efforts and resources were thus directed towards an equitable distribution of health services and facilities to improve the well being of the entire population in both rural and urban areas. (Juntunen, 2001). Several health plans were formulated with the aim to improve equity, accessibility and efficiency of the national health system (for details see Kopoka, 2000). The First Five-Year Plan (1964–1968) was issued, which emphasized the establishment of a countrywide system of rural health centers, each providing integrated health care and supervising a number of satellite dispensaries. The aim was to extend the health services into the rural areas with particular emphasis on preventative aspects. While the number of dispensaries, rural health centers and rural medical aides rose dramatically (Juntunen 2001), rural health services faced a shortage of funds since they were under the control of the local government. Thus, the overall results of the First Five-Year Plan were limited due to the lack of local resources and qualified staff (Kopoka, 2000). This led to a reassessment of Tanzania's development goals and new policy initiatives, which culminated in the introduction of the Arusha Declaration.

Inline with the Arusha Declaration, Tanzania pursued a health policy aimed at providing equal and free access to health facilities and services to the entire population. A second Five-Year Plan (1969–1974) was developed emphasizing self-reliance and equitable distribution and access to public services and resources in the country. This plan further oriented health services toward preventive services. Health services were provided free of charge by government institutions while voluntary agencies charged modest fees. The third Five-Year Plan (1976-1981) was later introduced which emphasized the provision of clean water, general services in rural communities and training of paramedical staff.

The 20-year Long-Term Plan (1981-2000) was developed with the objectives of strengthening preventive services, human resources, and community participation, which were also implied in the specific objectives of the National Health Policy approved in 1991 (Sabai, 1995). During the 1990s, Tanzania started to decentralize the health system through the devolution of political, administrative and financial power from the Ministry of Health (MoH) to the district councils. This enabled the councils to manage the health facilities and to allocate local funds for council health staff salaries, and the purchase of medicine and equipment. The MoH headquarters was responsible for making and monitoring health policies and reforms, such as in 1996 when they instituted cost sharing for health

services, a scheme criticized for marginalizing the poor and disadvantaged groups (Kopoka, 2000; Munishi, 1995).

In general, the Arusha Declaration sought to restructure the health sector as part of a comprehensive strategy to ensure sustainable development based on the principles of socialism and self-reliance. This included a shift from the existing curative focus to preventive measures, abolition of existing urban bias and the establishment of a viable rural health care network within the spirit of self-reliance. The most significant outcome of the Arusha Declaration was the effort to make health care comprehensive, universally accessible, and free of out of pocket payments to the general public (Kopoka, 2000). In the era of the Arusha Declaration, the Government was the major provider and financier of health services and emphasis was on the provision of Primary Health Care Services. This led to a massive expansion of health services particularly in rural areas with a corresponding expansion of training facilities for health workers.

However, provision of health care was adversely affected after the economic recession of the 80's due to inadequate allocation of resources and a shortage of qualified staff. Many service facilities operated at low levels of efficiency and many social services previously provided free of charge, now needed to be paid for, which could not be afforded by the poorest and disadvantaged groups (Kopoka, 2000). The lack of resources and capacity contributed to poor service delivery and a shortage of medicine. To-date, while malaria remains one of the nation's biggest killers in all age groups, HIV/AIDS and tuberculosis are becoming significant killers in contemporary times. The growing rates of these pandemics are affecting people's life expectancy, decreasing economic productivity, and increasing mortality rates.

Tanzania's social indicators are still unfavorable (MoH, 2003). According to the World Health Report of 2004, life expectancy at birth dropped from 51 years to only 43 years in the last 15 years. Infant and under-five mortality rates remain relatively high with 104 per 1000 live births (in 2002 compared to 1970 which were 129 per 1000 live births) and 165 per 1000 live births (in 2002 compared to 1970 which were 218 per 1000 live births) respectively (World Development Report, 2004). The number of orphans in Tanzania is increasing and in 2004 it is estimated that there might be up to one million orphans living in Tanzania (UNAIDS/WHO, 2004), mostly due to the HIV/AIDS epidemic. The growing number of orphans has also impacted the health status of children and adolescents. However, despite these problems, an objective of the Tanzania health policy has been to increase life expectancy and improve maternal and child care services.

The national health information system (HIS) is yet another impediment to the efficiency of health service delivery, providing unreliable and untimely information that is not able to adequately support health management (Mwangu, 2003). Health managers and managers at the local level in general regard the current HIS merely as an upward reporting system that is not appropriately developed to support their day-to-day health delivery and management work (Mwangu, 2003).

## **2.2 *The contextual shaping of the health sector***

Four contextual influences on the health sector are described: i) the spread of facilities; ii) investments in the health sector; iii) the human resources issue; and iv) decentralization.

### **2.2.1 The spread of health facilities**

In the early stages of the independence in 1961, there were very few health facilities, inadequate health personnel and a lack of adequate equipment. In total there were 22 health centers and 875 dispensaries operated by local authorities as well as approximately 100 hospitals, 40 of them run by voluntary agencies such as churches (Juntunen, 2001). The majority of the population was socially and economically excluded and limited efforts were made towards their social development, particularly for those in rural areas.

With independence in 1961, Tanzania started building a health system according to the standards of the industrialized world. The policies adopted since independence have largely focused on the construction of health facilities which has resulted in a large network of various village health posts, MCH clinics, dispensaries, health centers, district hospitals, regional hospitals and referral hospitals countrywide. This expansion was intended to reduce the inequalities between urban and rural areas and particularly to strengthen the historically neglected areas related to health promotion, prevention, and the countering of endemic diseases. In recent years, private health facilities have also been established in increasing numbers, especially in urban areas in order to provide commercial health services. Consequently, the Tanzanian Mainland has a fairly well distributed health care system. About 80% of the population has access to health services and over 90% of the population lives within 10 km of a health facility. There are about 4,844 health facilities of which 2,877, 848, 283 and 836 are government owned, voluntary, parastatal, and private respectively (MoH, 2003b).

Although efforts have been made towards improving the supply of drugs and training of staff, the quality of health service delivery does not yet meet the minimal standard of quality services (MoH, 2003b). Statistics show that there is still a shortage of trained health care personnel in the country, e.g. the population per nursing staff is 1000:1 and per physician is 23 000:1 (MoH,1996.). The government health facilities face a shortage of qualified staff and an overall fragmentation of the health system, affecting the collection of quality data and the use of information for health improvement and management.

### **2.2.2 Investments in the health sector**

The share for the health budget as a percentage of the total government budget fell continuously from 7.1% in 1977/78 to 3% in 1984/85. This trend was reversed after 1993/94 with a sharp increase to 11.4 % (Kopoka, 2000). Decades of under-funding have left health services with an urgent need of improvement, especially with regard to the repair of infrastructure, repair and replacement of medical equipment, transport and communication systems, and the training and hiring of staff with adequate skills and knowledge (HERA, 2006).

The centrally financed system saw a rapid expansion of the network of public health facilities during the 1980s and early 1990s, but at the same time severe pressure on the health budget in the context of structural adjustment. While the objective was to offer free health care for all citizens (as stated in the 1967 Arusha declaration), coverage and quality of services has remained low due to low levels of public funding. Since 1993, influenced by the need to generate additional resources, a policy shift has taken place taking focus away from the provision of universally free health care. Since then sources of funding for health care and funding mechanisms have become more diverse. This has added to the challenges faced by councils in integrating different planning tools, funding streams, administration and reporting requirements.

Tanzania is assisted by many international donor organizations in the provision of health services in different forms. The donors provide financial and technical assistance to the Ministry of Health for the running of various national, regional and district health programs and for buying medical equipment and medicine. Most of the assistance is usually extended to the government or routed through international organizations such as the WHO and UNICEF. The Health Sector is one of the priority sectors of the Tanzanian Government as is reflected in the annual incremental increase in budgetary allocation to this sector. Presently, 11% of the budget is allocated to health, with a target of 14% (MoH, 2003). However, within the budget for the health sector, the budget allocation for health services has remained inadequate and donor-dependent, focusing largely on curative services and the acquisition and distribution of facilities (Kopoka, 2000).

The central Ministry of Health provides funds to referral hospitals and medical schools as well as parastatal organizations such as Muhimbili National Hospital, Tanzania Food and Nutrition Centre and the National Institute for Medical Research (NIMR). The Prime Minister's Regional Administration and Local Government Ministry provides funds for regional and district hospitals including salaries for their employees. It also provides subsidies to local councils for the salaries of employees running health centers and dispensaries. District councils are responsible for the administration of health facilities in rural areas. The councils are also supposed to finance health services through tax collection and other local earnings in addition to financial support from the central level, for example for the purchase of medicine and equipment, to pay salaries and support training. However, in some districts revenue collection is low and under funded. Inadequate funding co-exists with under spending because of avoidable delays in cash flows from national to the district level, delays in the upward flow of plans and reports and an over centralized approval procedure (HERA, 2006). The funding for district health services comes from a variety of sources including government funding, centrally funded vertical health programs, Local Council contributions, basket funding (foreign sources), cost sharing and the Community Health Fund (HERA, 2006).

There has been a continued insufficient allocation between central and local government shares, despite a stated commitment in the Health Sector Strategic Plan to decentralize and improve the performance of district health services in particular. For example, in the Financial Year 2004, the revenue generation base of the Councils was dramatically reduced following the abolishment of the

development levy and other taxes which were not fully compensated for by funds from the central level. At the same time, the flow of compensatory funds from the central level was rather unpredictable which had an adverse impact on council budgets for health.

The Health Sector Basket Fund (with a 'central basket' for MoH recurrent expenditures, and a 'district basket' for local government expenditures through district grants that can be spent by district councils) was set up in 1999 as a joint donor financing mechanism. Allocations are made on a per capita basis (\$0.5 per capita and year). 10% of the district funds are earmarked to finance community based health activities (HERA, 2006). Basket funding continues to play an important role in supporting operations within the health sector, both through the recurrent budget support to MoH headquarters, and through the grants to Local Government Authorities. Between the financial Years 2000 and 2003, the share of basket funding in recurrent health spending has increased from 5% to 25%, with a subsequent reduction in the financial Year 2004 to about 15% as a consequence of the move by Department for International Development (DFID)-UK from the health basket to General Budget Support.

User fees as an element of cost sharing were introduced with four main objectives: to curb the unnecessary use of health facilities for non-essential health care services, to generate additional resources to complement government budgetary allocations, to improve availability and quality of health services, and to improve equity and access to health services. The cost sharing implementation program was finalized in 1993, and the gradual introduction of user fees took place from July of the same year. Today, user fees are charged universally in government hospitals, but in only a small percentage of public dispensaries and health centers. A review of available evidence (Maternal Health Financing Profile, 2002) describes how outpatient visits to public hospitals declined by half in the year following the introduction of fees, as did the number of attended births. However, over 50% of all patients in public hospitals are either exempted from paying fees or their fees are waived. Revenue is used to buy drugs and supplies, to pay for staff allowances and incentives, and for maintenance and transport.

### **2.2.3 Human resources issue**

In 1995, Tanzania developed a Human Resource for Health (HRH) policy, which formed the basis for its HRH strategic plan for the period 1996-2001. The plan strongly focused on improving the quality of the workforce, and key strategies were to strengthen continued education and reduce the number of unskilled staff. Reducing the number of unskilled staff was seen as a way to both improve the quality and to create financial space for increased salaries of the skilled workforce. However, the health budget is largely financed by donors who usually consider human resource issues to be beyond their scope ( Mæstad, 2006). The high foreign investment in the health sector makes Tanzania very aid dependent and consequently subject to donor influences. These influences have contributed to a multiplicity of donor supported information systems, which have implications on the efficiency of human resources.

Human resources are the most critical factor in the health sector of Tanzania (MoH, 2003). According to the report on human resources for health in Tanzania by Mæstad (2006), there has been a sharp decline in the number of health workers in Tanzania between 1994/95 and 2001/02 especially in lower skilled cadres. As a result, the present number of health personnel in Tanzania is low both by international standards and relative to national staffing norms. There is also some evidence of low skill levels among clinicians and low motivation to comply with professional guidelines in clinical work. The 2001/02 Census counted 48,500 health workers, down from 67,600 workers in 1994/95. In key cadres, such as nurses, clinical officers and laboratory technicians, employment in 2002 was 50% or less of the staffing norms agreed in 1999 (Mæstad, 2006).

Skilled human resources (skilled staff includes all clinicians, including assistant clinical officers, as well as professional nurses) are required to provide and manage quality health services at all levels and to cope effectively with the current, emerging and re-emerging health problems. There is a critical shortage of health staff in health facilities including limited trained resources (rural medical assistants) for diagnosing and treating patients in the rural health facilities. The ratio of qualified against unqualified staff is low, even though many qualified people were unemployed (Bijlmakers et al., 2004). The presence of epidemics, endemic, emerging and re-emerging diseases and pandemics such as HIV/AIDS in the country emphasizes the need for increased skilled human resources. Although the national health policy of 2003 indicates the need to enhance human capacity at different levels through deployment and retention of well-trained and motivated staff (MoH, 2003), this process had been going at a low pace. Typically, there is significant evidence of inefficiency in service delivery, inequity of staff distribution, inefficient skills mix of staff, and an increasing burden of AIDS (MoH, 2003b). The health worker crisis is evident through the shortage of personnel, geographical imbalances in the availability of health workers, and weak productivity and performance at health facilities ( Mæstad, 2006).

According to the 2003 report on Technical Review of Health Service Delivery at District Level in Tanzania (HERA, 2003), the lack of skilled human resources was mentioned as the number one problem in terms of quality and quantity of health services. The number of staff in the CHMT and the RMO's office seemed to be adequate. The number of staff working in the health facilities was not according to approved staffing levels. There are variations in the level of success in filling posts between districts, as the more isolated regions have more difficulties attracting skilled staff.

The existing clinical and health management information systems in Tanzania are complex and paper based. These paper-based systems are prone to enormous inaccuracies of information due to poor data recoding procedures, resources and skills. In the health facilities, health workers are often engaged with the task of taking care of a multitude of patients in parallel with reporting data. Several evaluations and reviews (such as HERA, 2000; Mwangu, 2003; MoH, 2002) conducted of the data reporting systems in the health facilities has revealed the availability of large amounts of information and data that were not fully utilized to inform managers on day-to-day health and management issues. A number of reasons were reported to contribute to this situation such as the inadequate number of

health personnel, lack of incentives, lack of skills in HMIS and poor managerial capacity in evidence based decision making.

In general, the health sector has been struggling today to fill the gaps caused by the move of qualified staff from the public to the private sector due to relatively higher pay. Qualified health staff who attend medical school in urban areas are also often reluctant to be transferred or work in rural health facilities. Under current reform efforts and conditions of increased economic growth, the government is seeking to further strengthen and expand the provision and management of health services and increase incentives to its qualified health staff with special consideration for those working in rural areas. A study on human resources for health in Tanzania by Kurowski et al. (2004) critically looked at the availability of staff and future projections of human resource needs in view of demographic change and the expected burden of disease. The report concludes that the number of staff needed is estimated to double in 2007 and triple by 2015. HIV/AIDS related interventions are expected to take 40% of health workers' time in 2015.

The human resources crisis in the health sector has been recognized at the highest political level. Former president Mkapa (1995-2005), in his address to the Annual Meeting of Regional Medical Officers in August 2005, emphasized the shortage of health personnel as a serious problem that required urgent steps. The recruitment restriction on the clinical officer cadre was lifted as of January 2005. In order to speed up the recruitment of vacant positions the government has also reinstated central recruitment of clinical officers, contrary to the intention of the decentralization reform. The Ministry of Health is arguing that central recruitment should also be reinstated for nursing cadres ( Mæstad, 2006).

The shortage of human resources especially in rural areas significantly influences the decentralization of health services and current computerization efforts. Council authority on staff matters is still very limited. There is no incentive for Councils to manage human resources efficiently and to hire competent staff (HERA, 2003).

#### **2.2.4 Decentralization of health services and HIS**

The Tanzanian health sector currently operates with goals to improve the quality of health services and increase equity in the access to and utilization of health services through decentralization. The goals, described in the report titled "Proposals for Health Reforms, Ministry of Health, 1994 (HSR)" and National Health Policy (2003) covers aspects of managerial reforms or decentralization of health services; financial reforms, such as the enhancement of user-charges in government hospitals; and the introduction of the health insurance and public/private mix funding models. Also included are organizational reforms such as the integration of vertical health programs with general health services, and expanding the numbers and scope of private health facilities. The objectives of the 2003 National Health Policy (MoH, 2003) are "to raise and improve the health status and life expectancy of the people of Tanzania by ensuring delivery of effective, efficient and quality curative, preventive, promotive and rehabilitative health services at all levels" (p. 37).



The health system is decentralized with the devolution of health planning, budgeting and health services delivery to the district level (with Local Government Authorities and Council Health Management Teams playing a crucial role). The financial reforms include new responsibilities assigned to local councils such as the introduction of new financing schemes for health care including the introduction of pre-payment schemes and fee-for-services. The management and administration of health services has been devolved into district councils through their respective Council Authorities, Council Health Service Boards (CHSBs), Facility Committees and Council Health Management Teams (CHMTs). While the CHSB reports to the Council, the CHMT reports to the CHSB (a unit comprised of the DMO, District Planning Officer, community representatives, and councilor responsible for social welfare committee).

The CHMTs which works under the CHSBs are responsible for the supervision and monitoring of all district based health services in all health facilities. For example, when there are abnormal numbers of deaths of pregnant mothers, they need to determine their cause and identify resources needed to control such problems in the future. They are also responsible for supervising, coordinating and supporting the PHC sector, comprised of village health posts, health centers, dispensaries/clinics and the district hospital. The CHMT in collaboration with the CHSBs plans and budgets for the activities needed to manage, control, coordinate and support health services in the district on a quarterly basis. The quarterly reports gathered from each health facility include details of health services offered, efficiencies and deficiencies of the health facility (e.g. the number of staff present and missing), and infrastructure constraints. Based on these reports and priorities of disease burdens (guidelines from MoH), the CHMT prepares the Comprehensive District Health Plan (CDHP) which it submits to the CHSB.

The CHSB is supposed to evaluate the report before sending it to the district Council (a body comprised of district councilors and a chairman who is selected from the councilors), the District Executive Director (DED), and District Medical Officer (DMO) for approval. In addition to the preparation of the CDHP, the CHMT also prepares a diseases and activities report for the Regional Health Management Team (RHMT). The RHMT is responsible for supervising the regional health services on a quarterly basis as well as compiling the health information reports from all the districts for reporting to the MoH headquarters. Once the CDHP is approved by the district council, it is submitted to higher levels for assessment with respect to compliance to national guidelines, implementation status, appropriateness of interventions, adherence to procurement and financial regulations and quality (HERA, 2006). Finally, the central level disburses the required funds and mobilizes and supplies resources to the district level such as drugs and vaccines.

Although, the districts have been the focus for implementation of health programs, most planning has been “top-down” with minimal involvement of beneficiaries, or even the CHMT (MoH, 1998, p. 10). For example, the planning related to vertical programs is normally done by a donor with health officials from outside the districts. For example, programs such as HIV/AIDS and EPI are top down driven and the CHMT is only involved in the implementation (MoH, 1998). Also, the process of

the devolution of the health sector is not guided by sufficient communication from the Ministry of Health or the Prime Ministers Office Regional Administration and Local Government (MoH, 2002b), which is responsible for the administration of primary health facilities.

During the 1980s, Tanzania's health system had a number of disparate vertical programs with redundancies in reporting, creating a great burden in terms of resource utilization, duplication of efforts and work over load. Vertical programs like the EPI, Essential Drugs Program, TB and Leprosy, Control of Diarrhea Diseases and Mother and Child Health, previously had separate and parallel systems of data collection, compilation and reporting (Mwangu, 2003). The national health authorities regarded this collection of different ad hoc systems as too fragmented, top-down-oriented and ineffective for local decision-making. Consequently, the national MoH, with the help of several donors and other external consultants, started the implementation of an integrated paper and computer based health (management) information system (HMIS) in the 1990s. When it was conceived, it was intended to cover all levels in the health sector, to include all vertical programs (i.e. stand-alone, disease-specific programs), private facilities, and to support the agendas of health reforms through decentralization (MoH 1993). The roll-out of the paper based HMIS was started in 1993 and accomplished in 1997.

Despite the original intention of the HMIS to support decentralization and facilitate local ownership and use of data (Rubona, 2001), these visions have not been realized in practice. The HMIS today remains a top down driven system influenced significantly by international donor agencies. There has been a continued lack of reliance on effective information at the lower levels coupled with a high dependency on donors for provision of resources (such as data registers) and training at the higher levels. There are a number of problems related to information flows within the HIS, particularly the vertical and one way data flows. The reporting is often one-way with limited supervision and feedback from higher level authorities discouraging analysis and the use of data for local management activities.

The inefficiencies of the HMIS necessarily force the managers of the vertical health programs to develop their own systems, overburdening an already busy health staff. The vertical programs tend to use their financial power to select the type of data they want for specific diseases such as Malaria, Mother and Child Health, Tuberculosis and HIV/AIDS, reinforcing the lack of integration of the reporting systems and diluting the reform efforts aimed at integration. These vertical programs are coordinated by the MoH and financed by donors, raising serious questions about their sustainability (Kiwara, 1994). Presently there are more rather than less vertical programs (for example Tuberculosis and Leprosy), with each having their own information coordinators, material supplies (e.g. drugs), support equipment (e.g. cars), data collection mechanisms as well as specific data analysis tools (such as forms and registers, software and hardware).

Centralization of the routine HMIS is among the factors that influences low use and poor quality of information at local levels. Indicators, data collection instruments, and reporting forms are typically designed by MoH officials with minimal or no involvement of local level managers or health

service providers. Despite the aims that the HMIS should be developed primarily for use at the health facility and to provide information suitable for local management and planning (Mwangu, 2003), health workers at local levels are not motivated to produce high quality data. Consequently, the health workers tend to collect data just to respond to the needs of higher level authorities without putting much emphasis on data quality.

Although decentralization of HMIS management towards the district level is recognized as an effective strategy to improve the HIS, the essential administrative and system functions of HMIS are not controlled by the CHMTs or CHSBs. The functions, including control over supplies and equipment for HMIS, purchasing and ordering of resources for HMIS and planning for training and defining the data collection tools are done centrally by the MoH. The CHMT members also have insufficient skills related to HMIS data collection, compilation, reporting, analysis, interpretation and use (HERA, 2000).

## ***2.4 Health Services Delivery in Tanzania***

The Tanzanian health system is decentralized with aims to promote preventive services. The structure of health care services and administration is described below.

### **2.4.1 Levels of health care delivery and administration**

The district council is responsible for health care in the district. Within the administrative structure there is a regional level above the district level. One region consists of several districts. Formerly, the regional administration was superior to the district council in all matters, but gradually, in the course of decentralization, the district level was granted significant decision making authority. However, the regional level retains a major role in the implementation of national health policy, quality control as well as the coordination and support of the districts.

The district health system is part of the national health system. It embraces all the facilities and individuals in a district involved in providing health care at various levels of intervention, not only the public health facilities, but also the private profit making health facilities owned by private providers, and private non-for-profit facilities owned by churches. The traditional healers are also part of the system, although there are few instances of cooperation between them as a result of their widely divergent views on the causes of diseases and how best to treat them.

The district health system is responsible for providing primary health care, i.e. organizing a minimum package of curative and preventive services in line with national health policy to respond to the health problems and needs of the local population. Within the district health system, there are two levels of primary and secondary services supervised, coordinated and supported by the CHMTs. The system also comprises village and community-level activities as well as the vertical programs.

The primary level is comprised of all health centers, dispensaries and similar facilities in the communities with staff such as nurses and midwives, but not doctors. The secondary level refers to all first referral hospitals for all services at the primary level. Generally, there is an official district

hospital in each district. Health services at the primary level transfers patients whose condition demands technology or skills not available at the primary level to the referral hospital.

The Tanzanian Health System is thus organized in a referral pyramid, starting from the village level, where there are village health posts and continuing upward to the: ward level, where there are community dispensaries; divisional level, where there are rural health centers; district level, where there are district or district designated hospitals; regional level, where there are regional hospitals; zonal level, where there are referral/consultant hospitals and the national level, where there are national and specialized hospitals. The current organizational structure is shown in figure 2.2

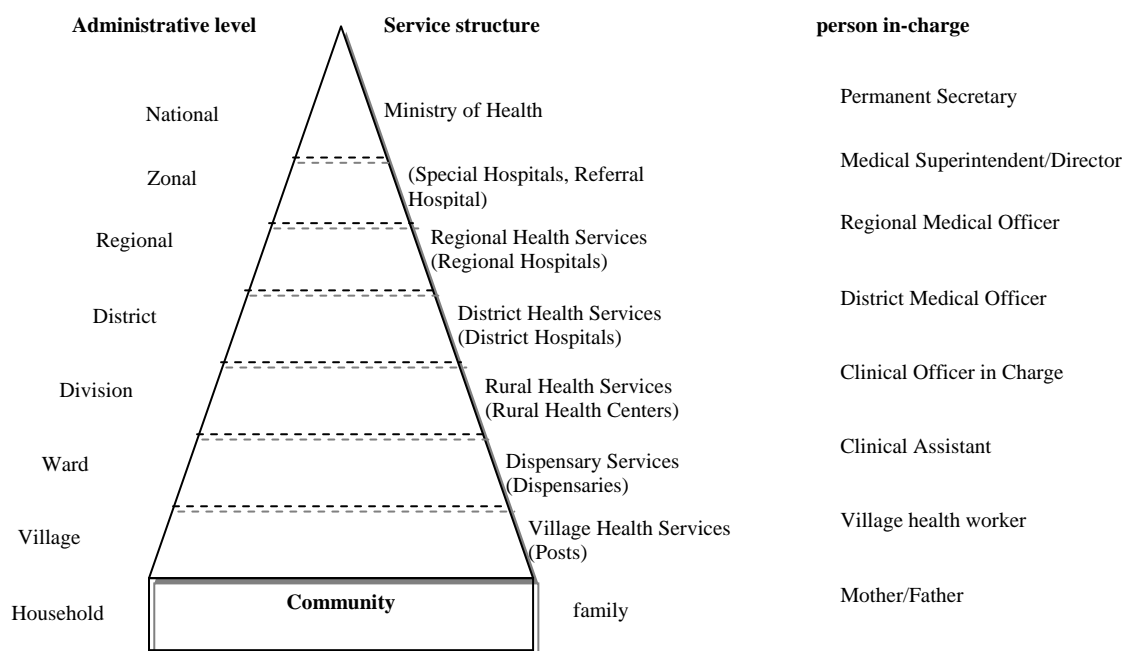


Figure 2.2 Organizational Pyramid of the Tanzanian health Services structure (MoH, 1998, p. 7)

The different roles and responsibilities that each block level of the pyramid plays in the health care system is now described (according Tanzania National Health Policy of 2003, i.e. MoH, 2003; and MoH, 1998).

- **Community**

Each individual and/or household has the responsibility to take care of the health of its own population. The communities have an obligation to their own health and are involved in addressing and solving health issues using the available local resources. The communities have to choose their own community health worker to be the main link between the community and the nearest health facility. The community health worker's responsibilities include health education and assisting in relevant public health interventions.

- **Village Health Posts**

The duties of Village Health Workers (VHW) include health education, advice and counseling on child care, pregnancy and family planning, AIDS prevention, data collection, counseling, and education, among other issues.

- **Dispensaries**

A dispensary serves around 5,000 people and supervises the village health services in its area. It is a primary health facility which offers outpatient services including reproductive and child health services (delivery services, immunization), basic diagnostic services and outreach services. The patients with complicated conditions are referred to higher levels following the established referral system. The dispensaries are also responsible to collect and utilize data to provide feedback to various levels including the community.

- **Rural health centers**

The rural health centers are primary health facilities superior to dispensaries, which offer Outpatient and In-patient services, maternity care, as well as laboratory, dispensing and mortuary services. The RHC also acts as referral centers for dispensaries. They serve a population of around 50,000 people. They (are supposed to) have appropriate transport and communication facilities for referral of patients to hospitals and supervision

- **District Hospital**

Hospital services in the district are offered by the District Hospital. It can serve up to 200,000 people. The hospital services include Out-patient and In-patient care, and it performs general surgical and obstetric operations. It acts as a referral center for the district and makes referrals to secondary and tertiary care institutions. The CHMT is responsible for all health services in the district irrespective of the provider. The District Health Officer (DMO) is the head of the CHMT and is the overall health manager responsible for district health services.

- **Regional Hospitals**

A regional hospital acts as a secondary referral facility for the districts. It serves a population of up to 1,000,000 people. The services are more specialized than the ones offered at the district level, including psychiatry, surgery, child health, obstetric and gynecology.

- **Referral Hospitals**

This is the level three and the highest level of hospital services in the country, which acts as referral center for level two hospitals. Diseases and cases which cannot be treated in referral hospitals, where necessary, depending on the availability of funds, are referred abroad for treatment. Currently there are four referral hospitals including the National Teaching Hospital at Muhimbili College of Health Sciences.

#### **2.4.2 Structure of the HMIS**

The HMIS is designed to follow the structure of the four levels of the health care sector consisting of the health facility, the district, the region, and the national levels. The national level constitutes the HMIS unit responsible for the HMIS activities countrywide such as implementation,

training, and user support. The health facilities are the origin of the health information. Routine health data are first collected at the health facilities and aggregated at the district health offices, where they are transmitted to the regional health offices and lastly to the national level. Thus, apart from delivering of PHC services, health staff at the health facilities (the health posts, dispensaries, and health centers) are responsible for the collection of health data in various forms and its transmission to the next level of the district.

- **Information processing at the health facility**

A health facility compiles health data collected on patients attending the health services as outpatients, inpatients or for Maternal and Child Health (immunization, family planning, weighing, and antenatal services) as well as from outreach activities including home based health delivery services and services at the village health posts. At the facility level, there are twelve registers (for Community Health, Outpatients, MCH (for example, family planning, antenatal care, and deliveries), Diarrhea cases, Dental, and tally sheets) and three types of tally sheets (for children vaccination, diagnoses, house visits, neonatal tetanus). All registers, tally sheets, report forms and manuals are in a mixture of Swahili and English. Only the HMIS forms are currently used for data collection, but based on these data program-specific reports are manually generated and collected by program managers. For hospitals, there are department sheets or registers, for example, for laboratory data. Each of the health programs has a separate data collection register book. The register is a set of forms for collecting data on different health activities concerning a particular program.

Data from the different registers are compiled in the health facility monthly data book. The data recording in this book is done on a daily or monthly basis depending on the particular program. The same data recorded in the health facility book is recorded in a quarterly reporting book (a three month report) where quarterly totals are summarized. Based on the quarterly book, an annual report is developed indicating the number of patients identified in a particular health facility classified by specific diseases. This annual report is comprised of a number of forms that have to be filled out in duplicate - one copy for the district level while one copy remains at the health facility. There are data that have to be reported every quarter and others only once a year, for example, data on equipment inventory must be reported at the beginning of each year. Also, there are data that have to be reported only from governmental health facilities, for example, in the renovation/maintenance report. Quarterly and annual reports have to be reported by all health facilities. The data on notifiable diseases are reported to the district level through a physical transport or radio call. The staff involved in the data processing are typically busy nurses with limited HMIS skills.

- **Information processing at the district level**

Each year each district receives a paper based District Processing File (DPF) whereby information from the individual reports of the health facilities is transcribed into tables in the DPF allowing district totals to be calculated. The DPF contains the working forms that are used to transform data from the health facilities into district aggregates and indicators. The DPF is divided into several information categories such as staffing, equipment, physical structure and notifiable diseases

and into quarterly and annual reports. The reports from the health facilities are aggregated into an overall district report and sent to the Regional Medical Officer (RMO) together with a copy of each health facility's annual report. One copy of the district quarterly report is also sent directly to the PHC secretariat at the MoH. Within each district health office, there is a district coordinator for HMIS. The coordinator is a focus person for the collection, aggregation and analysis of district health through the HMIS. The district HMIS coordinator has other responsibilities apart from the HMIS activities such as the delivery of health services.

- **Information processing at the regional and national (MoH) levels**

The district reports and a copy of each health facility's annual report are the sources of information that the regional offices have about each district from the HMIS. While the HMIS in the health facilities and the district is paper based, it is computerized at the regional health office. Most of the information reported from the district reports are entered into a computer system designed for the HMIS. This system requires data to be copied into floppy disk to be sent to the national level. The same computer system is installed at the national level for storing and analyzing information from the regional reports in the country.

### *2.5 Computerization of HMIS and ICT status in health sector*

With the development of a nationwide paper based health information system (in 1989-1992), it was realized that computers are required to facilitate the storage and aggregation of data from the districts and health facilities and to integrate the data from multiple health programs. Computerization of the paper based HMIS started in 1992 whereby an external software developer was hired to develop the HMIS software based on dBase IV. All regional health offices were equipped with one computer intended for the HMIS Dbase Software. The software was implemented in the MoH headquarters as well as in the 20 regional offices of the Tanzanian mainland in 1993. During the early period of its use, between 1993 and 1995, several software bugs were detected and change requests were collected. Since the first developer had left the country, another foreign developer based in Arusha was contracted to develop an improved version of the HMIS Dbase software.

In 1997, the paper based HMIS was subject to a major evaluation by the donor. As a result, a number of changes were suggested to the paper-based system. For example, new forms were introduced and the reporting frequency for health facilities was changed from a monthly to quarterly basis. These changes were introduced hoping that they would reduce the burden on health workers and limit the wastage of resources, thus improving the performance of the HMIS. However, these changes also implied fundamental changes to the Dbase software. Although, the MoH had the source code, the capacity to upgrade the Dbase system was not available. Instead, the MoH was advised to search for new software. The Dbase software was thus discontinued in 1998 (HERA, 2000).

The MoH, with the assurance of funding from the donor to meet the new development costs, contracted a local software company based in Dar es Salaam to develop new software using the MS-Access database management system. This vendor delivered an executable version of the software,

retained the source code and provided a 6-month post delivery guarantee. The system was installed in all the regional offices towards the end of 1998, to be used for the 1998 annual district and health facility reports. However, bugs were continuously identified, even six months after delivery. This required the MoH to secure extra funding from donors to improve the system every time new bugs were identified (Kimaro & Nhampossa, 2005). As the Ministry of Health did not own the source code and commanded no funds towards updating it, changes were not made until recently when a new development project was commenced after getting financial support from another donor. None of the districts were included in the original computerization plan, even though the current software is intended for data entry at the district and regional levels. However, the MoH has limited capacity to implement a district computerized system due to dependency on private vendors in the development and maintenance of the software. High implementation and training charges coupled with limited funding (most of which comes from donors) makes it difficult for the MoH to cope with the increasing demand for a district computerized system.

All the 20 regions that were computerized depended on the central MoH for funding all the computer related costs as well as for technical support. With recent decentralization efforts, lower levels in the administrative structure are being empowered to plan and maintain the system using funds under their control. However, little has been achieved due to the high cost of equipment, training, and the lack of local experts for training and maintenance. Although, each district has at least one desktop computer acquired through the MoH or a donor, only a few health staff has access to it or the adequate skills to use or maintain it. Some of these computers at the regions and districts are old models (486s with 4 MB memory and 200 MB hard disk running DOS and Windows 3.1), others have broken down and have not been replaced (HERA, 2000) due to inadequate budget and resources. The existing working computers are mainly used for data storage and processing or for secretarial services. The existing HMIS software is operated by poorly trained health staff that cannot use all the available data entry and manipulation functions. For example, when the HMIS software was replaced in 1998 (Dbase with MS access), no additional training on computer use was provided to the regional health staff apart from a brief introduction when the system was installed (HERA, 2000). As a result, the responsible health staff prefers to use either manual data processing or other simple applications such as MS Word.

A survey conducted by Ndumbaro (2003) in 5 out of 26 regions in Tanzania to assess awareness, level of current use and attitudes towards ICTs, indicated that only a few health professionals had received formal training in ICTs. The problems cited by Ndumbaro (2003) were the scarcity of expertise and skills in ICTs, inadequate infrastructure, limited finances and ICT support. The lack of financial and technical capability at the local level has affected computer maintenance, local adaptation, software development, and training. Typically, there is a lack of systematic training in place for computer and software use and a lack of a reliable local support network from the central MoH. Often the development of systems takes place at the national level with little involvement of the lower levels where such systems are later implemented, health services are offered and data collected.



Although, there are various international donor initiatives aimed at improving the health status of the population through the analysis of information using ICT's, these are in many instances fragmented and uncoordinated (Ndumbaro, 2003). The fragmented ICT initiatives in the health sector only produce limited benefits given the scarcity of resources in the health sector and the size of the health services. Presently, there is no information strategy at the MoH nor are there standard systems and procedures for sharing information between departments in the MoH and other ministries and partners in health (HERA, 2000).

Thus, although over 75% of the Tanzanian population lives in rural areas, ICT has not been fully exploited for the collection of patient based data and its transmission for decision making to the higher levels. The lack of communication infrastructure within Tanzania poses a serious problem for a system like the HMIS especially outside the city centers. The lack of infrastructure such as for example, telephone lines and tarmac roads, creates problems for communication between the district offices and the health facilities. The poor condition of the roads and insufficient funds, for example, for acquiring transport, constrains transport possibilities of health workers to reach their communities or the higher level health facilities. Although, a few regional offices have e-mail, the HMIS software is only set up for exporting/importing data to floppy diskettes. The software needs to be modified to incorporate this e-mail functionality (HERA, 2000).

The ICT policy finalized by the Government of Tanzania in 2003 outlines various issues including the need for continued effort for the development of ICT infrastructure and appropriate human resources in the country as well as the creation of an enabling environment for adoption and use of ICT in all sectors. So far, the government has waived taxes for computers and other associated accessories as a way to encourage the import of ICT equipment and services. In the health sector, the ICT policy indicates a commitment to develop and deploy the ICT based nationwide Health system. This system is aimed to support medical facilities in the under-served areas to generate information to better shape policies, plans, and decisions for improving the national network of health delivery system. Although there has been a commitment to introduce, support and improve the national HIS through ICT, little has been achieved and utilization of information is still low. Within the MoH, professionally qualified information and ICT experts are scarce and are often self-trained through their work exposure (HERA, 2000). There are no significant benefits that have been achieved so far in using ICT to improve the management and administration of health services in Tanzania (Ndumbaro, 2003). For example, limited work has been done so far on the use of ICT in the fight against HIV/AIDS, Malaria or Tuberculosis and the use of GIS technologies in the presentation of health information is largely non-existent.

## ***2.6 HISP implementation in Tanzania***

The HISP was inducted in Tanzania in July 2002 at the initiative of IS researchers from the University of Oslo in Norway in collaboration with the staff at the Department of Computer Science of the University of Dar es Salam, Tanzania. It was first introduced to the Tanzanian senior managers and

stakeholders by organizing a workshop in which HISP's underlying objectives and approaches as well as software capabilities of the District Health Information Software (DHIS) were articulated and demonstrated. Several key representatives from the Ministry of Health (MoH) also participated in this workshop. The routine health data provided by the Bagamoyo health district was used to demonstrate various functionalities of DHIS for storing, analyzing data, deriving and presenting useful information relevant to the various levels of the health staff functioning in Tanzanian health care administration.

The HISP's design and implementation philosophy is based on the decentralization of information management and decision-making roles in health sector to district and sub-district levels. This is in sharp contrast to the centralized, top down and inflexible hierarchical organizational structures existing in most developing countries for organizing and managing health related issues including management and use of associated information. Accordingly, DHIS has also been designed to be in consonance with this decentralization paradigm. For example, DHIS input-output interfaces are flexibly customizable, including multiple language support. The input data screens and output formats, thus, may be easily modified to work in any Unicode supported language and its alphabet. The health ministry/departmental organizational structures prevailing in a given country context (for example: central, province, district, sub-district etc.) can be easily incorporated accordingly in DHIS for data management and processing and information generation, reporting etc. This is a particularly useful feature since it allows the logical database structure to correspond to the actual organizational reality.

DHIS was first designed within a district-level setting in South Africa in 1998. In 2000, it was accepted as a national standard there for implementation in all districts (Braa, Monteiro, Sahay, 2004). Since then, the HISP approach to information management in the health arena has propagated to many developing countries, for example Mozambique, Malawi, India, and Tanzania. The DHIS related software and other allied activities taken up in these countries' specific contexts have, over the years, led to the establishment of a vibrant and active web-based network for collaborative technical development across time and space. This network facilitates sharing of knowledge and best practices amongst its various nodes. A main hub of this network is located in the Department of Informatics, University of Oslo, which presently tries to coordinate and support DHIS's software development ensuring it to be based on current technologies, providing country-specific as well as more universally required features as per growing needs of an ever expanding user community. A key attractive feature of DHIS for developing countries is that it has increasingly embraced a free and open source software development philosophy, and is provided by HISP at no cost to any organization.

Keeping in view the above advantages of DHIS, it was decided by the head of HMIS unit soon after the workshop that its pilot implementation be taken up in two districts (namely, Kibaha and Bagamoyo), pending approval of this proposed pilot phase by the MoH. Accordingly, HISP teams were constituted in both the districts. These teams comprised an inter-disciplinary group of researchers drawn from the public health and ICT domains, and were expected to work together with health workers and managers at different levels of the above-mentioned two health districts. The public

health experts helped in training of staff and also initiated participatory discussions for understanding the meaning of data, use of information in decision making and improving routine working procedures (such as how to generate quality data through timely reporting from the field). ICT experts as well as central level's key actors and other stakeholders also took active part in these participatory consultations. On the basis of these discussions, the ICT experts took up customization of the DHIS as per the identified local needs, training of health workers and managers in the use of computers. These teams also took up study and assessment of the existing HMIS's organization and associated work routines to better understand the context of DHIS's planned implementation. In sum, besides customizing DHIS in the local context and its implementation, the main focus of these efforts was to address key challenges posed by the existing paper-based HMIS (such as the lack of appropriate technical capacity to collect, analyze data, and use information for local action), and to enhance the local capacity for effective use of the computerized system.

The initial funding for the pilot implementation was provided by the Norwegian Government through University of Oslo's (Department of Informatics) research funds. In order to support HISP over time, concerted efforts have been directed towards seeking adequate financial support from the Ministry of Health (Tanzania mainland), as well as from the other international donor agencies.

While the first DHIS prototype was installed on PCs in the two pilot districts, training in use of the software was organized in parallel. Further customization of DHIS was also carried out based on identified user needs in consultation with them. This phase of customization included, for example, how to add or modify data elements to the database (such as number of deliveries, in-patients), defining indicators for status monitoring at the local levels, augmenting validation rules, modifying several features depicted in the graphical user interface (such as labels, text boxes, logos and images). The locally required modifications also included facility to edit the language interface, switching from one language to another (e.g. from English to Swahili) in input-output screens and printed outputs, and how to define new reporting formats to meet routine as well as ad hoc local needs. Thus, implementation of DHIS in the two districts has entailed a continuous process of customization. Care was also taken to introduce the computerized system gradually and in incremental steps for ensuring users' acceptability, and to provide them with sufficient time to get accustomed to the new data processing environment, for example to be able to populate the database and generate reports, identifying anomalies in the input data for seeking health managers' interventions for corrective action.

Hands-on training of users and other health workers has been an important strategy to build up their confidence in computer use to overcome their initial hesitation and fear of adopting a new technology, thereby enhancing their confidence and the appropriate use of the system. This approach to skill development has also resulted in the users' feeling increasingly empowered to take up some customization activities on their own. Trainings of health workers on data collection, information use and its interpretation have also helped in increasing acceptance of DHIS and its use being gradually inscribed into the routine work procedures of health departments at the district level.

- **Local and Global HISP collaboration to support human capacity building in the health sector of Tanzania**

Collaboration between the Tanzanian HISP and the global HISP has helped in the initiation of an officially sponsored HMIS course for health information workers and managers (nine months) as a way to scale up training that started in the pilot sites, and to augment the availability of trained manpower in the health departments. The first course began in February 2005, being hosted by the Department of Computer Science at the University of Dar es Salaam, Tanzania. It comprises three phases of study, viz., theory, practical (empirical work in the field), and thesis writing. The course contents include: introduction to HMIS concepts, need for health sector reforms, improving data quality, planning and standardization of HIS, inculcating computer basics and understanding DHIS software. After completing this theoretical part, students select a specific aspect of HMIS for a more detailed investigation within their own work setting. The objective of this phase is to encourage students to suggest improvements in the existing systems, organizational structures, software in use etc.

The HMIS course is conducted by several local and international faculty (from health and ICT disciplines) that reflects the sharing of expertise in this emerging inter-disciplinary arena of health informatics. For example, the faculty who participated in teaching and supervision of the course participants came from Norway (ICT), Mozambique (Public Health), South Africa (Public Health), Ethiopia (Public Health and ICT), and Tanzania (Public Health and ICT). A unique feature of this training was in articulating and exposing participants to HISP related case studies drawn from local, national, and international levels. In 2005, most of the course participants were from Tanzanian mainland (mainly from the HISP pilot districts). Other participants were from Malawi, funded by the Norwegian Agency for Development Co-operation (NORAD), as well as from the Tanzania Zanzibar, funded by the Danish International Development Agency (DANIDA) through the Ministry of Health of Zanzibar. In 2006, the participation further scaled up by enrolling personnel from the other districts and regions of Tanzania and Malawi as well as Ethiopia.

- **Sustainability and challenges of the HISP**

Since the inception of HISP, the inter-disciplinary teams have gradually involved stakeholders from all levels to strengthen the program with their increased support by way of local financial or human resources. This is a first step taken for ensuring the long-term sustainability of the HISP. With this goal in mind, the HISP group has been concentrating on two fronts: (i) the local, to ensure that the locally customized DHIS is fully accepted and replaces the manual HMIS; and, (ii) at the national level, in a continuous political brokering process to elicit participation of the national HMIS personnel and management. Both these processes are inter-dependent. A typical excuse by the national level personnel for not fully participating in training and customization of the system, is the lack of time due to their many other responsibilities including the operation and upkeep of the existing HMIS. Understaffing of the national HMIS unit is also cited as the main reason for their relative absence from participation in the DHIS initiative. Thus, although some national level health personnel were part of

the HISP team, their participation was only partial and unpredictable. Notwithstanding this reticence, however, the other HISP team members (including myself) are committed to seeking fuller participation from the national level, particularly in taking long-term and strategic decisions about the future trajectory of the project, and to ensure its sustainability. The HISP team is also attempting to tackle the vexatious issues of power relations and imbalances, and has sought allocation of additional resources to conduct more training, as also to maintain local HMIS till DHIS is fully institutionalized. Replacement of the national head of the HMIS unit during this brokering process made it even more difficult to obtain national-level approval of the project, financial support, and its participation in technical activities of the HISP. As a result of lack of national-level commitment and delay in formal approval of the project, district management showed some reluctance in the use of DHIS in their daily work, as they were awaiting “a nod from the top.” On the other hand, the national level staff claimed that were waiting for tangible results to be demonstrated by the pilot districts before moving forward – a typically deadlocked situation.

The above brief description reflects some of the key challenges HISP Tanzania has had to face, viz. those related to the lack of good quality of data within the paper-based HMIS, inadequate human capacity for computer-related work, lack of motivation and time from senior managers to participate in the project. The experience of implementing HISP in most other developing countries also faced like roadblocks and impediments. Therefore, HISP’s philosophy has been to accept these ground realities, and to work not only towards a gradual process of change with regard to the user acceptance and full scale use of DHIS, but also to alongside promote much needed reforms in the existing top-down organizational structures.

The fact that most health facilities are understaffed and inadequately financed, in addition to being often remotely located and difficulty of access has made it difficult to organize training of health workers at health facility level. At the facility level, data handling is done by health workers who have little or no background in basic statistics or use of computers. The district information coordinators (in the two pilot districts), apart from their engagement with the paper-based HMIS, are also responsible for providing clinical services and to coordinate vertical programs. This multiplicity of roles has led to “work overload” and fragmentation of information processing within the health organizations in Tanzania. As a result, there is inadequate support both for the paper-based HMIS and computer-based DHIS. The lack of adequate human capacity further exacerbates the above described rather grim situation on the ground.

As mentioned, to address the above challenges, the HISP teams have organized on-site and off-site training for health workers on the use of basic computer functionalities, use of DHIS, and teaching them essential data handling skills. Training programs have also been designed for district-level information coordinator/ managers as well to suit the requirements of regional and national level officials. Alongside, discussions are continuing with health officials and managers at various levels to sort out data handling issues. Public health experts in the HISP team have been actively in these

discussions. However, training programs designed for senior managers have not yielded the desired results and made little impact due to their scanty participation.

The local work processes and organizational aspects of the existing paper-based HMIS also contribute to the limited progress of HISP and rather ineffective use of DHIS. This is partly explained by the problems that exist in HMIS itself, for example gaps in the data collection methods continue to hinder DHIS's effective functioning. Since the managers did not participate in the DHIS training sessions due to conflicting activities and responsibilities, they do not have knowledge about what kind of useful information DHIS can produce to facilitate their working and decision making capabilities.

Despite the above challenges, the new national head of HMIS unit said that the Ministry of Health was ready to continue to give support to new initiatives such as HISP. He permitted DHIS to operate in parallel with the manual HMIS database until the ministry and its policy-makers are convinced of the DHIS's potential. However, in order to do so, HISP's decentralized approach needs to be given a fair trial along with more vigorous implementation of DHIS.

HISP's explicitly stated goal is to support local levels of health care. However, to succeed it requires the active and positive involvement of national health authorities in order to contribute to local capacity building, to facilitate change, and to transfer resources for local sustainability of the DHIS. Although the HISP team has tried to involve stakeholders at all levels, the managers and policy makers at the higher echelons of the health hierarchy, at the time of writing, have by and large provided only lip service to the cause of HISP, and it is still far from being accepted as a national system. However, this project has continued to get external support from donors such as NORAD and European Union (EU) to sustain their ongoing activities in Tanzania. The recent discussions between the HISP team (local and global) and the new manager and staff of the HMIS unit at the Ministry of Health has led to the formulation of a joint proposal to augment MoH's involvement in HISP, strengthening of the district DHIS software and pilot sites, and to formally assign responsibilities in this regard to all participating agencies. Approval of this proposal by MoH is awaited.

### ***2.7 Summary of Tanzania country profile, health care sector, and status of HMIS***

Country Profile	Health sector	Current computerized HIS
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<ul style="list-style-type: none"> <li>• Population: 33.5 million (2002 census data)Area: 945,087 sq km</li> <li>• Major Languages: English, Swahili</li> <li>• GNI per capita: US\$290</li> <li>• Poor transport and communication infrastructure in rural areas</li> <li>• One of the poorest countries in the world, heavily reliant on foreign aid</li> </ul>	<ul style="list-style-type: none"> <li>• Life expectancy: 42 years (M), 44 years (W) Under-5 mortality rate 165 (2003)</li> <li>• Malaria, TB and HIV/AIDS are major killing diseases</li> <li>• Administration of health services decentralized</li> <li>• HMIS centralized with four hierarchical levels</li> <li>• Local collection, aggregation and upward reporting of data with little feedback and local use of data.</li> <li>• Severe delays and data quality problems, high work load on health workers with no motivation and incentives</li> </ul>	<ul style="list-style-type: none"> <li>• MS Access based, developed locally by local vendors, but source code and not retained by the MoH.</li> <li>• All maintenance and extensions of the software need to be renegotiated and occur on a contractual basis with financial support dependent on donors.</li> <li>• Specific reports collected by program managers, based on data from HMIS forms but using forms different from HMIS creating health workers' work overloads</li> <li>• Lack of training on basic computer maintenance at lower levels</li> </ul>
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In this thesis, I discuss the context, opportunities and the challenges for implementing HISP. In summary, the given background helps to situate the study of HIS in terms of its context, history, and current status of the health sector. In the next chapter, I describe the theoretical framework used to aid the analysis of empirical data.

## CHAPTER 3

### ***THEORETICAL PERSPECTIVES***

I have chosen to employ “new” institutional theory to explain various aspects of institutions and their role in the change process associated with the HIS. However, it is argued that institutional theory under-theorizes technology artifacts, and thus there is a need for an additional perspective to provide insights into the technological change associated with the HIS. For this purpose, I draw on concepts from the information infrastructure perspective, especially the concept of installed base (both technical and institutional) and how it shapes the trajectories of the HIS.

This chapter consists of five sections. In the first section, I present some key concepts from institutional theory that are relevant for studying processes surrounding decentralization and sustainability. In the second section, I draw on the current socio-technical conceptualizations of information infrastructures to elaborate on a perspective to analyze the HIS. In the subsequent section, I discuss how the HIS can be better conceptualized as a Health Information Infrastructure (HII). In the fourth section, the notion of cultivation from the information infrastructure perspective is drawn upon in order to elaborate on the change process of the HII. In the last section, I attempt to integrate various discussed concepts to develop my theoretical framework.

#### ***3.1 Institutional Theory***

In this subsection, I elaborate upon key aspects of institutional theory and argue why and how they are relevant to analyze issues of decentralization and sustainability. These aspects are grouped into three subsections: 1) institutions, institutionalization, and legitimacy; 2) organizations, organizational field and contradictory influences, and; 3) institutions, stability and change.

##### **3.1.1 Institutions, institutionalization and legitimacy**

DiMaggio & Powell (1991b) describe that in “old” institutionalism, focus was placed on issues such as values, norms and attitudes, individual organization, along with power and informal structures. In contrast, “new” institutionalism puts emphasis on legitimacy, the embeddedness of organizational fields, practical actions, and routines (DiMaggio & Powell, 1991b). Institution represents a “social order or pattern that has attained a certain state or property” (Jepperson, 1991, p. 145). In other words, institutions are socially constructed, routinely reproduced rule systems that are comprised of taken for granted norms and rules that produce patterned ways of doing things and acting in the organization (Jepperson, 1991; Scott & Meyer, 1983). A key aspect of institutions is their self-reproducing or repetitive nature, that is, the fact that they exhibit stability and order.

Economists and political scientists view institutions as regulative systems, involving rules and enforcement mechanisms. North argues:

*[Institutions] are perfectly analogous to the rules of the game in a competitive team sport.*

*That is, they consist of formal written rules as well as typically unwritten codes of conduct that*



*underlie and supplement formal rules...the rules and informal codes are sometimes violated and punishment is enacted. Therefore, an essential part of the functioning of institutions is the costliness of ascertaining violations and the severity of punishment (ibid, 1990; p. 4)*

North (1990) conceptualizes institutions as rule systems (formal rules and informal constraints) and enforcement mechanisms that are developed to regulate the behavior of individuals in-line with prescribed rules (e.g. a formal/legitimate authority to enforce compliance) in the organization. The rules, either formal (written rules) or informal (norms of behavior, unwritten codes of conduct), constrain and enable the behavior of individuals, including what individuals are both prohibited and allowed to do under certain conditions. The formal rules and informal constraints are sometimes violated and punishment is enacted based on existing enforcement mechanisms. Through informal constraints, individuals may also be pressured to conform to appropriate behavior in given situations (North, 1990) in the organization. However, Scott (1995) argues that institutions involve more than just rules and enforcement mechanisms in the organization. The organization consists of socially constructed actors endowed with differing capacities for action and roles to play (Scott, 1995). Under this conceptualization, practices of HISs, for example, are performed by roles such as district information coordinator. Also, the behavior of actors is guided not only by natural endowments and interests but also by moral beliefs and normative obligations.

In addition to rules, norms and cultural beliefs, institutions also encompass associated behavior of actors and material resources (Scott, 2001). Rules, norms and meanings occur in interactions and activities as they are produced and modified by human behavior. According to Scott (1995 & 2001), normative, regulative, and cognitive analyses are needed to provide a complete explanation of institutional behavior. Thus, Scott (2001) describes institutions as being “composed of cultural-cognitive, normative, and regulative elements that, together with associated activities and resources, provide stability and meaning to social life” (p. 48). Although, Scott (2001& 1995) emphasizes the cultural-cognitive view of institutions, he views institutions as being a multi-dimensional concept. New institutionalists emphasize the cognitive dimension of institutions and are concerned with how individuals perceive or interpret data within their frames of meaning (Scott, 1995; DiMaggio & Powell, 1991b; Giddens, 1984).

The **cognitive** view defines institutions by their use of symbolic elements (e.g. words, signs, and gestures) and systems of meaning (e.g. common beliefs and shared logics of action) to intermediate between the environment and behavior in organizations (Scott, 1995). Social arrangements and beliefs shape the behaviors and actions of actors both individual and collective, within an organization and are constantly reinforced. Meanings occur in interaction and are maintained and transformed as they are employed to make sense of ongoing actions. The cognitive view concerns human actions, preferences, and motivations and how they are socially constructed. The **normative view** defines institutions by the use of values and norms. Values represent certain standards to which existing structures or behaviors of actors can be compared and assessed (such as certification and accreditation) (Scott, 1995). The norms define work procedures and legitimate means through which goals can be achieved

(e.g. rules specifying how data is recorded and analyzed, conceptions of quality data practices). Some values and norms are collectively shared by all actors in organizations while others may only apply to few actors. Specialized values and norms are termed as roles (Scott, 1995). Norms impose constraints on social behavior and empower and enable social action. They also provide authority, responsibilities and incentives - actors conform not only to satisfy their own interests but because of what is expected of them (Scott, 1995). In the health care delivery, there are norms governing three activities for providing health care to patients and data recording. These activities, their meanings and the norms govern the rights and duties expected of actors in interaction and constrain their everyday working practices and roles. The **regulative view** defines institutions by the use of rules and laws to regulate or control the social behavior of individuals within organizations (Scott, 2001). It involves the authority to establish rules, evaluate conformity to those rules, and provides sanctions (rewards or punishments) in attempts to influence future behavior.

Institutions are constituted of actors who are constrained, empowered and controlled by their normative and historical contexts. Thus, “institutions do not merely reflect the preferences and power of the units constituting them; the institutions themselves shape those preferences and that power” (Keohane, 1988, p. 382). Institutions are transmitted by various types of carriers including cultures (e.g. values and beliefs), social structures (e.g. norms and rules), routines (e.g. habits, protocols, and standardized procedures, roles), and artifacts (e.g. specifications, conventions, and standards) (Scott, 1995; Scott, 2001). The conceptualization of institutions is often confused with “culture” described by Jepperson as follows: “those forms of ‘consciousness’ [such as ideas, understandings, ritual, etc.] with socially coordinating effects [which] may be less or more institutionalized” (Jepperson, 1991; p.151). Institutions can be differentiated from cultures although they can also be embedded in cultures.

- **Institutionalization**

Individuals within organizations become habituated to accepting the norms, rules and meanings of the institution through the process of institutionalization (Tolbert & Zucker, 1996). The local institutionalization of a HIS for example involves creating new roles, structures, meanings, responsibilities, technical procedures for the production of data and budgets to ensure that the system becomes part of the existing routines, social structures and cultures. Institutionalization processes enforce constraints such as techniques, policies, and standards associated with the HIS, and these constraints may with time become accepted as normal and routine, for example routines around data collection and reporting. Routines are also maintained by shared assumptions about their legitimacy and necessity, which may not always be based on efficiency and technical benefits (Meyer & Rowan, 1991). As institutional constraints become established, the degree of their institutionalization (or persistence) increases by creating more roles, features, and meanings (Peters, 1999) and their acceptance by a larger network of actors. Institutional constraints can be less or more objective (non-personal) depending on the situation and the roles and positions occupied by the actors (Zucker, 1991, p. 86). Institutions are characterized by their stability and ability to shape action, the behavior of individuals and their ability to provide individuals with legitimacy. The degree of institutionalization

of practices or systems depends on the extent to which the members' actions in an organization have a shared value and meaning, taken-for-grantedness, and accepted legitimacy (Jepperson, 1991). Highly institutionalized actions have cultural persistence as such actions are shared by various actors (Avgerou, 2002). For example, although the national HMIS in Tanzania was institutionalized in the health care administration, it was seen as convenient to fulfill the data needs of higher level managers, however, failing to provide useful data for local action. The existing HMIS was not effective in terms of generating output for local level benefits or possessing the local flexibility to adapt to new changes (Kimaro & Nhampossa, 2005).

- **Role of legitimacy in institutionalization**

Legitimacy is the “condition reflecting cultural alignment, normative support, or consonance with relevant rules or laws” (Scott, 1995, p. 45). Institutions develop as repeated patterns of behavior that evoke shared meanings among individuals (Scott, 1995). The legitimization of this order involves connecting it to wider cognitive frames, norms, or rules. For example, while the existing paper and computer based HMIS in Tanzania was designed with the aim of integrating existing vertical programs, the respective program managers were not consulted in the design process. As a result these managers did not trust the HMIS leading into presence of fragmented and parallel reporting systems. The lack of wider legitimacy of the HMIS is reflected in the following quote from a regional information coordinator :“Even though there were HIV/AIDS, tuberculosis, MCH coordinators in the same regional or district level they could not cooperate with the national HMIS coordinator to collect, share or compare their data.”

Organization legitimacy refers to “the degree of cultural support for an organization” (Meyer & Scott 1983, p. 201). It entails the support of various types of cultural and political authorities empowered to confer legitimacy. “The legitimacy of a given organization is negatively affected by the number of different authorities sovereign over it and by the diversity or inconsistency of their accounts of how it is to function” (Meyer & Scott, 1983, p. 202). Each of the three views (cognitive, normative and regulative) demonstrates different kinds and degrees of legitimacy. For cognitive theorists, routines are followed because they are taken for granted as efficient, without evaluation of their outcomes. The normative view emphasizes the power of roles, and normative expectations guiding behavior. The incentives for conformity may include intrinsic and extrinsic rewards. The regulative view emphasizes conformity to rules and laws (Scott, 1995). According to Jepperson (1991), “legitimacy may be an outcome of institutionalization or it may contribute to it, but illegitimate elements can clearly be institutionalized” (p.149).

The enduring characteristics of institutions commit individuals to behave in ways that may even violate their own individual interests (March & Olsen, 1989). In practice, however, there are circumstances in which individuals violate norms or interpret institutional values differently depending on the given emphasis to individual judgment (Peters, 1999, p. 39). Thus, Peters (1999) defines institutions as a “collection of rules and incentives that establish the conditions for bounded rationality” (p. 44). Although, institutional constraints (values, norms, rules) shape the behavior of

individuals, when they are imposed from the “top” with little understanding of the “ground”, this may lead to non-conformity (Peters, 1999; Meyer and Scott, 1983). However, in some organizations, non-conformity may lead to punitive action depending on the type and effectiveness of enforcement rules in place (North, 1990).

Organizations are deeply embedded in their institutional contexts and are supported and constrained by institutional forces (Scott, 1995). Organizations are shaped by institutions but at the same time, organizations play an important role in shaping their institutions (Meyer and Rowan, 1991).

### **3.1.2 Organizations, organizational field, and contradictory influences**

North (1990, p. 3) emphasizes the distinction between organizations and institutions, arguing: “if institutions are the rules of the game, organizations are the players”. Organizations such as firms, agencies, schools and colleges are collections of people engage in objective functions such as educating students and regulating businesses (North, 1990). Organizations enable human agency to be articulated and expressed through various ways, for example, through structures of work, control mechanisms, reward systems and ownership. Organizations operate in institutional environments and collectively develop beliefs and norms that are embedded in formal structures to guide their activities and actions, including their technical work. (Scott et al., 2000). Members of organizations share common understandings about what is appropriate and meaningful behavior (Zucker, 1983). Formal structures and work practices continue to exist, even though they have little to do with efficiency since they are maintained by shared assumptions about their functionality and necessity (DiMaggio & Powell, 1991b; Scott 1987).

Health care organizations incorporate institutions as they encompass formal rules (such as policies, plans and guidelines) and informal constraints (such as culturally agreed upon behavior) (North, 1990). Individuals (health workers and managers) working within multiple levels of health care organizations have different codified cultural rules and social routines. In their daily working and interaction, they appropriate and employ these broader cultural frameworks and also improvise and invent new understandings and interpretations that guide their activities (Scott, 1995). Broader cultural beliefs as well as individual self-conceptions are the product of social processes. At the local level, preferences and rules received from higher levels are not simply taken as given; they are institutionally shaped, meaning that they are interpreted and become infused with a taken-for-granted quality in which actors unwittingly accept them as appropriate way of doing things. Often participants at the local level interpret the formal rules differently and develop informal constraints that are incompatible with the prescribed formal rules because of lack of incentives and the presence of weak enforcement mechanisms and culture of information use. This situation creates a gap between the prescribed formal rules and informal constraints which influence attempts to change, such as health sector reforms.

Although organizations are shaped by both technical and institutional forces, they are also influenced by other organizations in their environment, collectively referred to as the organizational field (DiMaggio and Powell, 1991a). The concept of organizational field denotes the existence of sets of differentiated, interdependent organizations or entities that “*constitute a recognized area of institutional life*” (DiMaggio & Powell, 1991a, p. 64-65) that interact closely with one another and their contextual factors provide varying influences to organization structures and processes (Scott, 2001). The different organizations comprising an organizational field exert varying influences because of their different characteristics, pressures or geographic locations (Scott, 2001). They also exert normative and regulative influences among each other and share similar activities. For example, a health care organization and its policies and processes are shaped by various entities such as civil society, donor agencies, NGOs, the WHO and the government. This organizational field is constituted by formal and informal institutions which create multiple influences on various processes (Piotti et al., 2006) including the processes of decentralization and sustainability of the HIS. Apart from material exchanges amongst these entities, such as informational reports, plans and policies, or financial disbursements and material supplies, the organizations within the organizational field exert normative, cognitive or regulative influences upon each other (Avgerou, 2002). These influences are exercised at multiple levels in health care organizations, shaping activities such as the disbursement of funds, training, or the conduct of supervision. The actors in an organizational field may be located in the same or different geographic location, and can also represent different levels of the health care organization. Their varying influences, arising from geography, levels or other conditions, provides the potential (or not) for decentralization of the HIS.

Scott et al. (2000) employed three components when they studied the changing nature of institutional environments in the health care sector namely institutional logic, institutional actors and governance structure. Institutional logic refers to “the belief systems and related practices that predominate in an organizational field” (Scott, 2001, p. 139). Institutional logic provides the guidelines for guiding activities as to how field participants are to carry out the work. Some participants (organizations in the field) are characterized by certain central sets of beliefs, whereas others are characterized by either secondary logics (that compete for adherence) or conflicting belief systems. For example, the fragmented nature of the operation of donor funded health care programs. Governance structures refer “to all those arrangements by which field-level power and authority are exercised involving, variously, formal and informal systems...regulative and normative mechanisms” (Scott et al. 2000, p. 172-173). For example, the governance systems for vertical health care programs often influence the functioning of the national HIS. Participants (organizations), individual and collective, are capable of exercising power to affect and alter existing systems and rules. The interests of participants are shaped by their location in the field and they endeavor to have their interests reflected in governance structures. The institutional forces of an organizational field may be contradictory (Avgerou, 2002). Different organizations (local, national, international) may exert conflicting pressures to the organization to adopt their models and values. The existing

institutionalized practices and structures may be in conflict with emerging new rationalized myths or models in its environment

The multiple levels of the health care organization are composed of different institutions, each with their own central logic, set of material practices, and symbolic constructions that constitute the organizing principles that individuals and organizations draw upon to resolve contradictions (Friedland & Alford, 1992). Institutional environments are pluralistic, with inherent inconsistencies amongst the institutionalized elements which can lead to contradictions (Meyer & Rowan, 1991, p. 56). For example, the existence of various levels within the health care administration, each with different institutional influences, often leads to contradictions (Jepperson, 1991). Contradictions may arise since institutional rules are couched at very high levels of generalization, making it difficult for them to be interpreted similarly by different people in practical settings (Piotti et al., 2006; Meyer & Rowan, 1991). The formal rules of the HIS such as routines for data collection and reporting as well as the definition of data elements and indicators are often defined by the National HIS authorities, which are not interpreted and understood similarly by individuals at different levels (Piotti et al., 2006). The acceptance and enforcement of such top down practices at lower levels are in practice difficult and contradictory since they are implemented in a formal and top down manner, primarily as a technical process that de-emphasizes the informal constraints at the lower levels (Piotti et al., 2006).

Some unplanned actions may be carried out due to political and organizational reasons (Sahay & Walsham, 2005) creating further contradictions. For example, ad hoc requests of data and reports from higher level officials constrain people at the local level in fulfilling their planned activities. Further, the conditions on the ground also contribute to contradictions. Also, training may fail to result in a change in practice due to weak management participation and support, poor use of information (Williamson et al., 2001) and lack of computers on which to practice. Over time, this leads to limited use of the systems. Scott (1995) argues that the presence of contradictory or conflicting rules creates room for individual discretion, strategic behavior and choice. These various contradictions provide the source and potential for change, as actors and organizations may seek ways to cope with these inconsistencies.

### **3.1.3 Institutions, stability and change**

Organizations provide institutional contexts within which particular actors are located and take action. Organizations influence how institutional frameworks evolve and are shaped by institutions in order to achieve their objectives (Freeman, 1988). The institutional framework provides the basis for informal face-to-face negotiations, for example, to help analyze existing commitment, to build support, and to provide the momentum for change. Organizations are historically produced social systems whose formal structures and processes are sustained by systems of shared meanings (e.g. values, symbols, ideologies, rituals, and myths) among their members (DiMaggio & Powell, 1991b; Meyer and Rowan, 1991).

Institutional change involves changing the old set of shared beliefs, rules, social norms, and practices to be replaced by new rules, forms, and scripts (Scott, 2001). When organizations are forced to change, they are also subjected to a number of choices which together reflect their institutional framework, struggling to balance between new changes and existing institutions (Olsen & Peters, 1996). In practice, the structural and cultural changes in social structures, motivation, people's capabilities, and leadership are central to ensure sustainability of the system. However, these tend to be slower than technological change (Williamson et al. 2001) because of their historical and institutional embeddedness (Zucker, 1991).

Although institutions function to provide stability and order (making them resistant/persistent to change) (Jepperson, 1991), they are subject to change process in an incremental (slow, gradual) or radical (fast, sudden) manner (Scott, 2001; Greenwood & Hinings, 1996). Changes often occur incrementally because of weak organizational learning, commitment and support, and the normative embeddedness of an organization within its institutional context (Greenwood & Hinings, 1996). The changes often need to be made through the efforts of skilled members of the organization that have the capacity to make sense of new circumstances and continuously share and reshape their meaning and value systems (Scott, 2001; Zucker, 1991). The formal rules (as a result of change in laws or regulatory rules) can be changed but yet informal constraints (such as norms, conventions, or beliefs) can persist since they are culturally derived and thus take a longer time to change. North (1990) explains that while formal rules may be changed overnight as a result of political decisions, informal constraints usually change gradually as they are socially and historically embedded. Although institutions may be transformed over time, they can retain much of their past history, referred to as "sedimentation" (Tolbert & Zucker, 1996). However, when past rules and choices are inadequate, an organization may develop superior alternative institutions (Peters, 1999).

Institutions can create contradictions among groups within organizations as a result of different or divergent beliefs and practices undermining the stability of each, which can provide the impetus for change (Scott, 2001). As a result, they can be modified or de-institutionalized (a process by which institutions (sets of beliefs and practices) weaken and disappear as a result of de-legitimation, the abandonment of institutionalized practices) (Jepperson, 1991) or re-institutionalized (opt for alternative institutions, creation of new beliefs and practices) through radical change (Greenwood & Hinings, 1996). DiMaggio (1988) argues that "institutional work is undertaken by actors with material or ideal interests in the persistence of the institution...: where such interests are not present and influential, de-institutionalization occurs" (P. 13). For example, the institutional influences or interests of various levels of health care organizations or entities of an institutional field can contradict each other (Jepperson, 1991). According to Piotti et al. (2006), such contradictions can provide a basis for change. For example, the presence of successful alternatives (e.g. new rules and models) can cause interests to shift which may in turn lead to de-institutionalization of existing institutions that have become inefficient and suffered a loss of legitimacy.

Institutional changes take place as a result of a combination of various internal and external factors or as a result of internal pressures. Organizations are composed of functionally differentiated groups or units with different conceptions, value preferences, and sectional interests. Greenwood and Hinings (1996, p.1032) identify four aspects of an organization's internal dynamics (the forces that produce activity and change): *interests*, *values*, *power dependencies*, and *capacity for action*. The organization is viewed as consisting of various groups such as nurses, doctors, statisticians, and health managers in the case of health care organization structured by functional tasks and employment status. These groups have alternative ways of viewing the purposes of their organization, how it might be appropriately organized, and ways in which actions might be evaluated. Groups also seek to translate their interests into favorable allocations of scarce and valued organizational resources. A potential pressure for change and/or inertia may be the result of their dissatisfaction on how their interests are accommodated within an organization. A high pressure for change following dissatisfaction may not lead to change, unless the dissatisfied groups come up with an alternative solution with its origins linked to the institutional context. However, different levels or units of organizations may have different patterns of value commitments and adhere to a different set of institutional norms leading to competitive or conflicting commitments.

In addition to interests and value commitments, radical change can occur only in conjunction with an appropriate capacity for action (availability of skills and competencies, understanding of new changes and having the ability to manage change process) and supportive power dependencies. The power enables the groups to promote their interests for change. However, groups within an organization vary in their ability to influence organizational change because of asymmetric power dynamics. Power is the "capacity to determine outcomes within and for an organization, a capacity grounded in a differential access to material and structural resources" (Ranson et al. 1980, p. 7). Groups of professions can use favorable power dependencies to promote their interests, and define norms and standards, and allocation of budget through their ability to influence organizational change. For example, the presence of the local power for planning and management of the HIS can enable the local administration to enforce rules and work practices of HIS and to create roles, budget, and incentives for health staff involved with the HIS.

While some researchers regard the control of scarce resources as the most important factor in the creation of power dependencies others have argued that the crucial basis of power is the skill- the skill to use existing resources and mobilize support (see Ranson et al. 1980). Availability of capacity for action gives the organization the confidence to go ahead with change. The action (of values, interests, power, and capacity) comes from organizational actors who have positions, skills, commitments, and histories (Greenwood & Hinings, 1996). Without the capacity for action, change is unlikely to occur even if there may be a motivation for change. Power dependences and capacity for action are necessary but are not sufficient conditions for change (Greenwood & Hinings, 1996). According to Scott (1995):



*Institutional rules invent rationality, defining who the actors are and determining the logics that guide their actions...if actors pursuing interests take actions to create institutional frameworks, this can only occur under particular circumstances in which selected actors are constituted as having those interests and powers (p. 140)*

The capacity for action always requires organizational learning (Levitt & March, 1988), involving new skills and knowledge. However, the kinds of knowledge, skills and learning that individuals acquire often reflected the incentives embedded in the institutional context (North, 1990). The change from one working environment to another involves designing new organizational structures and systems, learning new behaviors, and interpreting phenomena in new ways (Greenwood & Hinings, 1996). The institutions within organizations can remain unchanged if individuals are unaware of them or do not bother with them (Jepperson, 1991). Organizations identify and adapt to changing circumstances in their environment through a process of learning and by responding to new information that comes from their experience. However, this learning depends on the ability of individuals in the organizations to validate, process, and interpret that information. These consequences are shaped by the extent to which changes in rules and norms are accepted (or not) by individuals (Olsen & Peters, 1996, p. 69), and the effectiveness of enforcement (North, 1990). Moreover, the values that individuals bring with them from other organizations or academic training influence their actions and resulting change processes (Peters, 1999).

Change also comes as a result of external forces. Sometimes organizations are forced to change to conform to contextual expectations of other similar successful organizations and to increase their legitimacy. DiMaggio and Powell (1991a, p.66) identify three distinct mechanisms through which institutional isomorphic change occurs: coercion, imitation, and normative professional conduct. Coercive pressure happens through formal or informal persuasion or force. Public sector organizations are more likely to be responsive to institutional pressures (e.g. pressures from regulatory agencies such as the state and the professional associations), for example to adopt decentralization to comply with donor funding policies or other legal and regulatory requirements (Scott, 2001). Imitation occurs when an organization voluntarily mimics institutionalized, successful practices of another organization in a response to uncertainty. For example, through the transfer of skilled labor, organizations can import and institutionalize new rules and practices. Normative change is associated with professionalization-“a collective struggle of members of an occupation to define the conditions and methods, [and standards] of their work” (DiMaggio & Powell, 1991a, p. 70). The norms of professional conduct are produced and maintained through formal education and training as well as through professional associations. The normative pressures from social expectations of quality health care can make health managers abide to professional working standards of preventive care that require the use of routine information for making decisions. Institutional changes (such as work practices and the structure of work) can also be triggered by external events such as the introduction of technology based information systems (Barley, 1986; Avgerou, 2002) or external changes in the broader political and economic policies and rules of employment (Scott, 2001).

Although normative and regulative obligations can be rationally crafted, cognitive elements result from more or less rational process and may be produced by informal collective interactions which reflect the existing institutional framework (Scott, 1995 & 2001) and supportive infrastructures. Although organizations can respond to institutional pressures, institutional environments can influence and delimit the kinds of strategies organizations can employ (Scott, 2001). Institutions define and set limits on the appropriate ways of acting including actions taken in response to institutional pressures. According to Scott (2001, p. 171), strategies, tactics, and structures transferred from one context to another are “institutionally shaped” through further interpretation, negotiation, and adjustments to allow for successful local institutionalization. The various collections of actors within different levels of organizations or fields interpret the rules differently which thus need to be adapted and amended to suit the local context (Scott, 2001).

The decentralization process is influenced by both internal and external forces as it involves the reorganization/change of political, fiscal and administrative functions such as political policies, decentralization of administrative activities, and budgetary provisions. Decentralization requires laws, regulations and directives that clearly outline the relationships between the central and local government and administration, the allocation of functions, the roles, authority, and duties of officials at the local level and their limitations (Rondinelli, McCullough & Johnson, 1989). Centralization of resources such as funding contributes to create legitimacy of the dominance of central control enforced through formal rules. Generalized models need not only be imposed as they are, but also modified and re-constructed (adapted) to fit into new contexts (Scott, 1995). Internal and external forces engaged in decentralization reforms provide the potential for change by enabling the decentralization of administrative structures, the development of capacity building efforts, and the rationalization of information handling processes (Piotti et al., 2006). However, in the current top down structure, with regimes of monitoring and enforcement, there are limited incentives and resources to adapt new structures and rules to the local level. According to Scott et al. (2000), changes in governance structures/authority often have strong influences on organizations. Changes in the logic tend to occur first, allowing for the construction of new types of social actors and new roles, followed by the development of new governance structures. Logics are based on ideas, which are generated by the creative actors within organizations through the formulation of new concepts, models and designs. When new ideas and interpretation diffuse and become widely accepted, they often become the basis for social life.

Decentralization is not a straightforward top down technical change process but it is rather a complex and continuous political and institutional change process (Rondinelli, McCullough & Johnson, 1989). It requires both creation of new institutions and a change in the attitudes and behavior of those in both the central and local level of organizations (Parry, 1997). It also involves incremental process of local capacity building, which is defined as the creation of ability to set goals, anticipate needs, make informed decisions, attract and manage resources in order to meet those goals (Parry, 1997; Rondinelli, McCullough & Johnson, 1989). One of the most important conditions for local

capacity building is the development of financial and human resources. The lack of financial resources can make the local governments fail to carry out the transferred functions and responsibility. In addition to financial resources, the personnel in the local level organization must have or develop the necessary skills and knowledge to support services of the decentralized system (Parry, 1997). The central government can support the local government through financial, technical and personnel assistance, or other services such as provision of regular training and guidance. However, the presence of knowledge and skills at the local level without power to make decisions cannot improve the efficiency and effectiveness of the decentralized system (Parry, 1997). Successful decentralization depends on the willingness of the central government to relinquish the power to make decisions to the local level. The political change involves creating central and local commitment, motivation, and support, and the local political administrative system (Keen, 1981).

From an institutional perspective, ICT is seen as a product of a social network embedded in social institutions (Avgerou, 2002). The insights from institutional theory provide understandings of various institutional influences (the social, cultural, and political aspects) shaping the use and introduction of ICTs (Orlikowski & Barley, 2001; Avgerou, 2002). Walsham (1993), has argued that development of an ICT based IS involves alterations in existing routines, scripts, beliefs, and associated activities governing interactions of the existing social system. Thus, introduction of new information systems involve changes in both technical and social systems (Orlikowski & Barley 2001). Although an institutional perspective provides strong insights to understand social aspects of IS development and use in organizations, it lacks a strong focus on the technical aspects of IS (Monteiro & Hanseth, 1995). For this reason, in the next section, I draw on information infrastructure theory as an additional perspective to provide deeper insights into the dynamics of technological change processes.

### ***3.2 Information Infrastructure***

In this section I draw on recent socio-technical conceptualizations of large, networked systems called information infrastructures. Hanseth & Monteiro (1998) studied the introduction and use of Electronic Patient Record (EPR) system in hospitals in Norway focusing on its institutional and infrastructural aspects. They argued that such EPR systems fail due to lack of appreciation of their infrastructural aspects and the existing institutionalized character of practices into which they are embedded. An information infrastructure is defined as a shared, evolving, open, and heterogeneous installed base (Hanseth & Monteiro, 1998b, Cibora et al., 2000, Hanseth & Monteiro, 1997). In contrast to the single, isolated, predictable, and manageable standalone traditional IS, an information infrastructure is seen to be open and evolving, meaning that it is not possible to fully delineate and predict a priori, and thus it is not manageable through conventional strategies.

An information infrastructure evolves over a long period of time, increasing in scope to include a wide range of (not pre-determined) activities, thus attracting a large and shared community of users and stakeholders (Hanseth & Monteiro, 1998; Ciborra et al., 2000). It thus acts as a foundation

underlying and supporting a wide range of activities in a community. As its use areas grow, more technical components and services are added enabling new functionalities and new usage areas which attract more users. An information infrastructure is thus, open in the sense that there are no pre-defined/determined numbers of actors involved or technical components that it may include. This however means that no strict border can be drawn between infrastructures or around one infrastructure since they are connected and interrelated, constituting “ecologies of infrastructures” (Ciborra et al., 2000, p. 59). For example, the World Wide Web is built on top of the Internet TCP/IP protocol. When one component or infrastructure is changed, the rest are also affected by the change process. The size and scale of information infrastructures together with the interdependent nature of their individual elements means that their evolution is beyond any one single actor’s control (Ciborra et al., 2000).

An information infrastructure is heterogeneous in the sense of having different systems, social and technical components including varying work procedures and use and changing requirements. Over time, new requirements emerge and infrastructures need to be adapted to remain dependent and appropriate to the communities. Thus, information infrastructures must be flexible and easy to adapt to new unspecified requirements, applications, and services to continue to grow and provide further benefits to the organization (Hanseth, 2001). The heterogeneous nature of an information infrastructure makes it be more than just ‘pure’ technology but rather a heterogeneous socio-technical network (Monteiro & Hanseth, 1998b; Monteiro & Hanseth, 1995; Ciborra et al., 2000), operating at various levels of the organizations, including technical components, human capacities, institutions, and work practices. Due to the size and complexity of an information infrastructure, it is often standardized to have a minimum set of functionality. Standards allow different solutions to work at different levels and existing different elements of an information infrastructure to be integrated through standardized interfaces, components, and protocols. Thus, without standards an information infrastructure cannot exist (Hanseth, Monteiro & Hatling, 1996). The evolving nature of an information infrastructure requires standards that are flexible and easy to change (ibid) to allow for future changes and to incorporate new requirements, features, and technologies stemming from new services or applications.

The concept of installed base refers to what already exists historically in the organization, both technical and non-technical (Hanseth & Monteiro, 1997), including existing standards, technologies, entrenched and institutionalized work practices, social arrangements, and organizational structures. A whole information infrastructure cannot be changed instantly since existing heterogeneous elements are institutionalized, interconnected and interdependent (Hanseth & Monteiro, 1997). New changes always have to be connected to the historical and pre-existing, the installed base. The installed base greatly influences how new information infrastructures are designed, introduced, used and sustained. The sheer size and degree of embeddedness is one important reason that information infrastructures evolve gradually by adding new parts to what exists or replacing existing parts with improved ones. This means that an information infrastructure is never developed from scratch but from an already existing installed base (Ciborra et al., 2000).

The process of changing, improving, or extending an installed base is thus referred to as evolving an installed base (Hanseth, 2000; Hanseth & Monteiro, 1998) or as its cultivation (Dahlbom & Janlert 1996; Aanestad, 2002). A precondition for an information infrastructure to evolve is that there is a possibility for new actors to connect easily to it, i.e. that it is standardised (interfaces, protocols etc). Standards are the basis for evolution, a necessary component. Standards can be of different kinds; they can enable or restrict growth of an information infrastructure. Flexible standards (flexible in specific ways) can accommodate growth/change whereas inflexible/closed/limited standards can not (Braa et al., 2006).

### ***3.3 HIS conceptualized as Health Information Infrastructure***

This section discusses how a HIS can be better conceptualized as Health Information Infrastructure (HII).

A HIS is a link between the health delivery and management systems and is embedded in multiple institutional settings covering various administrative levels. Various institutions are involved which shape people's behaviors and their actions that support information gathering, aggregation, reporting, and use (Braa & Nermunkh, 2000). The HIS is composed of a heterogeneous socio-technical network of actors, health facilities distributed in different places, and embedded standardized practices and technical components, dispersed, open, and shared within and across multiple levels of health care organizations. So the shift of a HIS from a single system to networks of systems, work practices, and actors requires an information infrastructure perspective that takes into consideration multiple actors and the installed base—both technical and institutional. A HIS can thus arguably be better conceptualized as a Health Information Infrastructure.

The communities of users sharing the HII and playing different roles include health facilities, health workers, health managers, statisticians, decision makers, stakeholders, Ministries of health and donor organizations. Although, there are different standalone systems, there is the transmission of routine health information from health facilities via districts to the available standalone applications using paper reports or diskettes. The HII is also open since as health facilities and health programs get connected, more users, services, and stakeholders are included, and with them further technological components are incorporated. Also donors and vendors contribute to the design and deployment of new technologies to facilitate data storage, processing, sharing and exchange of information between actors involved in different administrative levels and systems.

The HII is not created from scratch and is built upon the already existing system of health and administrative services including the various health programs. The existing installed base has important implications on how the evolution of the HII unfolds and the kind of strategies that are adopted in order to manage and control it. Standards are the key building blocks of the HII (Hanseth & Monteiro, 1998; Hanseth, 2000; Hanseth, Monteiro & Halting, 1996) helping to facilitate interoperability (Hanseth, 2000), integration, and coordination. Standards represent common rules that specify the kind of information to be collected and how and when it should be reported to the level

above. In addition, there are standardized manuals related to the roles and work procedures of health workers that explain, for instance, what tasks they have to perform, provide instructions on how to fill forms and specify data reporting frequency, data elements and the calculation of indicators. The hierarchical structure of health care organizations represents a mechanism to control and coordinate the HII whereby a health manager has the authority to instruct and command subordinates, for example, to report and supervise data collection.

Given the size, variety and complexity of the HII, it is almost impossible to control it in a top down manner involving a single locus of control (Ciborra et al. 2000). However, the local level control of a HII is not possible without the appropriate capacity necessary to extend and exploit a HII and deal with challenges of technology such as regular maintenance. The top down control of a HII often encounters the need for local flexibility (Braa and Hedberg, 2002; Hanseth, Monteiro & Halting, 1996; Ellingsen & Monteiro, 2003) which can create various contradictory influences. The standards of the HII help to control the fragmentation within the HII, but the change processes which are controlled centrally undermine these processes. Sometimes, bottom-up changes are resisted, requiring central level's mandate since such changes may require further commitment of resources from the central level. For example, the introduction of changes at the local level may require additional resources from the central level to support the processes of scaling and sustainability.

Typically, the HII demands sufficient resources and flexible standards (Braa et al. 2006; Hanseth, Monteiro & Halting, 1996; Rolland & Monteiro, 2002). The local level often requires detailed information to support local health management and requirements of various vertical health programs, raising the need for flexible standards. However, sufficient resources and human capacity are required to enable local users to deal with changing requirements and needs over time. The availability of local capacity depends upon the institutional design of decentralization. Due to its size and scale, the HII is difficult to change through the efforts of a few developers/researchers located in limited settings. It requires a team of collaborative actors from the large network of the HII to jointly deal with technical and institutional change as well as the political brokering. Also due to the interdependencies of the elements of the HII, a cultivation approach is emphasized. This is now described.

### ***3.4 Cultivation of HII***

A cultivation approach suggests a shift from the design of systems to a cultivation of networks and infrastructures. The design of systems is associated with the assumption that systems are isolated entities and it is thus possible to specify them completely and design them to solve specific organizational needs. On the contrary, cultivation suggests that an installed base (as represented by the multiple systems and network of actors) cannot be ignored because it involves an existing network of key actors, resources, and legacy technologies (Hanseth, 2002; Hanseth & Aanestad, 2003). Current research in IS (for example, Aanestad, 2002; Dahlbom & Janlert, 1996; Hanseth, 2002) has emphasized the importance of a cultivation approach to evolve information infrastructures such as HII.

Given the interconnected nature of the HII, it becomes important to change it in an incremental manner while taking into consideration existing installed base (comprised of the existing work practices, legacy systems, and multiple reporting systems of vertical health programs in this case).

A HII consists of a large network of multiple actors, entrenched routines, deep-rooted cultures and institutions working and operating in hundreds of health facilities and health and political administrative levels. It is indeed a very costly and challenging activity to replace the entire HII with a new one in a short time span because of its sheer size, inter-connectedness, and inter-dependent nature of its constituent elements. For example, some new changes carried out (e.g. changes of data reporting routines) often demands changes at both the higher (national) and lower (health facilities) levels. The installed base of a HII cannot be changed rapidly but requires a stronger focus on cultivation (Dahlbom & Janlert, 1996; Aanestad, 2002), which seeks to live within the limits of local control (Ciborra et al. 2000; Dahlbom & Janlert 1996). The preferred approach thus is to strengthen and nurture growth, through constant support, capacity building, continuous assessment, and a commitment to revise strategies that do not work well (Aanestad, 2002). The cultivation approach involves incrementally transforming and changing the installed base, keeping the well functioning elements and building on those elements. However, the process demands participation of key actors to be able to judge which elements are to be included or excluded and in which ways.

Cultivation is thus a long-term incremental change strategy which involves extending and growing upon an existing installed base rather than trying to radically change it (Hanseth & Monteiro, 1998b). The cultivation approach suggests that an installed base which includes both existing technologies and existing institutions cannot be completely ignored or done away with. The installed base is deeply embedded and institutionalized in the existing routines (Hanseth, 2002; Hanseth & Aanestad, 2003), social structures, and cultures of the organization. A realistic strategy for change of the installed base is thus to take a gradual change whereby new changes or improvements have to be linked to the previously installed base, either as extensions, revisions, or gradual replacements. The cultivation approach provides room for large organizations such as health care organizations to mobilize resources for local capacity building and support, develop new rules and norms, create local budgets, and develop learning and understanding of incompatibility between formal rules and local informal constraints. It also creates room for negotiations among actors to evolve according to a non-predictable dynamic. The rapid switch to the new system affects learning and local motivation to use of the system. For example during my analysis of the use of HMIS software at the regional level in Tanzania, the users claimed to have an inadequate understanding of how to operate the software, for example, for report generation. One of the users at the regional level said: “We do not benefit from the system actually. Previously, we were using DBASE system but they switched us to Windows immediately and we were not sufficiently trained on how to use it”

The cultivation approach implies an inherent need for flexibility, both in the technical systems and in the institutional structures to develop and to allow local adaptation (Hanseth, Monteiro & Halting, 1996; Byrd & Turner, 2000). The HII cannot be sustainable, unless there is flexibility to allow

organizations to seize a wide range of future, unplanned work process and redesign options (Ciborra et al. 2000). Thus, new changes must thus be institutionalized and the HII must remain flexible enough to accommodate emerging changes and to guarantee its legitimacy over time. The flexibility is crucial to help to integrate institutional characteristics of the individual level organization into systems (Volkow, 2003) to accommodate their needs and demands over time and space. For example, the change flexibility provides room for local administration to accommodate changes such as new reporting requirements from various actors such as vertical programs (Braa et al., 2006). The development of a flexible HII is however to be considered during its design and development rather than during its implementation or use.

The existence of inflexible or rigid elements of a HII such as legacy systems as in the case of Mozambique (Nhampossa, 2004) and standards often have great impacts on the cultivation approach. When the existing legacy systems are inflexible and incompatible with new changes, more resources and political brokering are needed (Monteiro, 1998). However, the failure or inefficiency of existing systems or standards can be taken as an opportunity to create legitimacy for the construction of new solutions and standards to cater for the needs that existing ones cannot address. A construction approach can thus be used which involves the creation of a new, novel solution from scratch however, with the danger of ignoring the importance of the installed base (Bergqvist & Dahlberg, 1999).

The construction approach can be combined with a cultivation approach in a situation where there is not a sufficient point of departure, while respecting the conservative power of the installed base. The new solution may be difficult to implement and subject to failures if it is not institutionalized into the existing network of the installed base (Hanseth & Monteiro, 1998), its key actors are not involved in the construction process, and if sufficient capacity is not built. For example, the lack of participation of the actual users of the existing HMIS software in Tanzania coupled with the developer's lack of understanding of the institutional context led to the development of a very incomplete understanding of local needs and the system. As described by one of the respondents interviewed at the regional level: "The MoH's authorities did not involve us during the design of this system. They just informed us that they will come with a new system. At our place, only two people know how to enter data into the HMIS software. However, we do not know how to generate reports from that data. We only know how to put data and create diskette for sending to the national level".

The participation of key actors is also required in order to translate and address their interests and needs into the system and to allow them to influence various decisions such as those related to the extent of local flexibility and centralized control of HIS in the health care organization. The participation of the users of the HIS in the development team can ensure local ownership and learning by interacting with developers (Puri, 2003). Participative design enables the integration of user interests and meanings to the system and the sharing of knowledge between developers and users (Schuler & Namioka, 1993) and thus creates a sense of ownership (Lorenzi & Riley, 1995) which has significant implications for the sustainability of the system. Participation is justified through the recognition of the failure of traditional development approaches (Fitzgerald, 2000), in which the



developer (while playing a leading role) specifies the entire system design, then develops the design as a software product, and finally puts this new product into use (installation and training) (Pressman, 1992).

According to Hanseth & Monteiro (1998), the co-existence of the “old” and the “new” incompatible networks can be established through a “gateway” that links them together. The gateway (also called a converter) is designed such that it receives data in one format and converts it into another format and vice versa. The gateway can also be used to link the existing paper based system with the new computer-based system. However, the cultivation approach can encounter problems when the key actors want quick results and benefits, especially top managers and donors who provide financial support. When the new gradual changes do not result into quick positive outputs, such change initiatives may suffer a loss of local legitimacy and higher level support and commitment of the key actors (Ellingsen & Monteiro 2003), leading to a situation of unsustainability. Consequently, the developers or researchers involved with the change process need to be sensitive to the interests of key actors in the network and must act to demonstrate short term benefits of the project to the local beneficiaries and senior managers. Thus, the cultivation approach is a necessary strategy, which must be aligned with the interests of all key actors within and beyond the sphere of project control.

### ***3.5 Proposed theoretical framework***

This chapter has reviewed the theoretical concepts drawn from the information infrastructure perspective and institutional theory as well as from relevant literature related to decentralization and participation. My proposed theoretical framework elaborates upon four sets of relationships, and their interrelationships: how are decentralization and sustainability interrelated, how decentralization and sustainability are mediated through participation, how decentralization and sustainability are mediated through capacity building efforts, and how decentralization and sustainability are influenced by the organizational field. The major theoretical issues addressed are summarized in figure 3.1

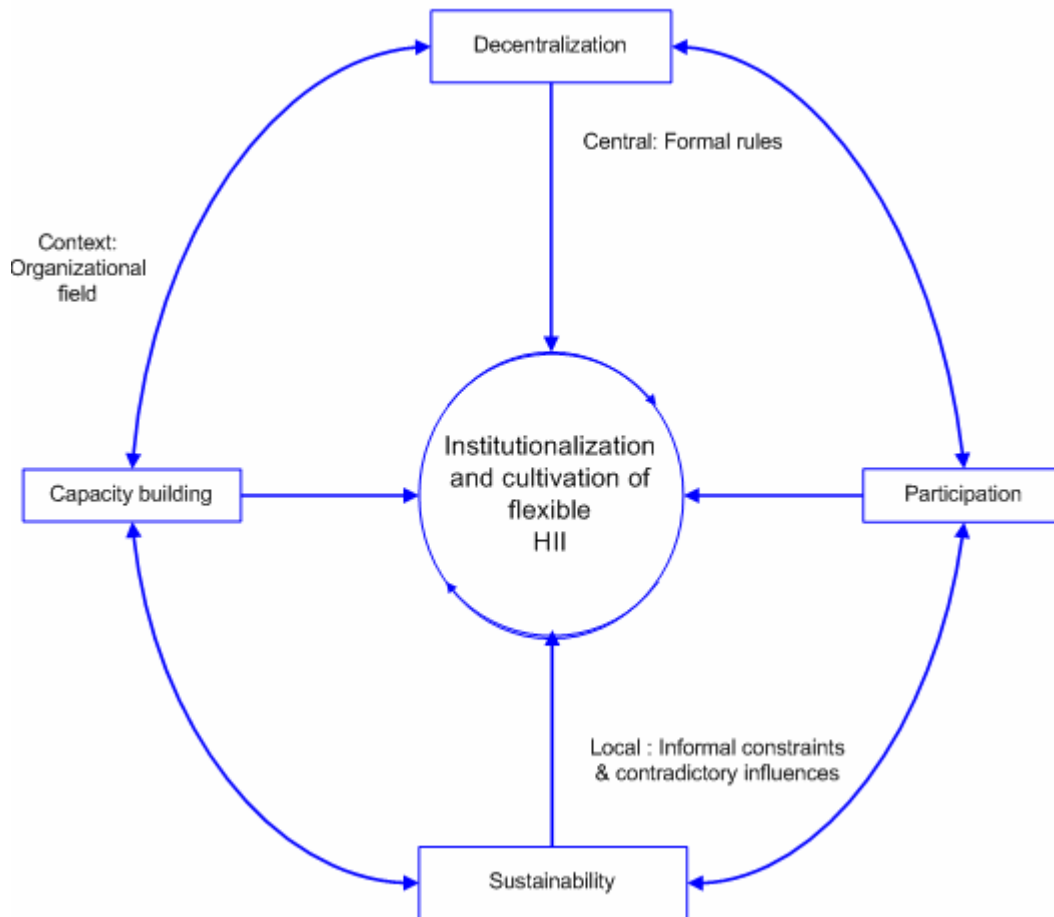


Figure 3.1 Decentralization and sustainability as a process of continuous institutionalization and cultivation of a flexible HII

As illustrated in figure 3.1, the decentralization and sustainability of a HII involves cultivating and institutionalizing a flexible HII, seen as a process of incremental change of the installed base of the HII (by integrating new changes) through processes of participation and local capacity building. It involves changing existing institutionalized practices, beliefs, and norms and introducing new norms, rules, and meanings associated with the HII. For sufficient institutionalization to happen, it demands a gradual, progressive change. Through the institutionalization and cultivation process, changes associated with the system “get rooted”, become the “new” status quo and sustainable because over time they are embedded into the organization and develop required wider legitimacy. I conceptualize decentralization of HIIs as the transfer of responsibilities and authority for decision making and planning over the HII from the central level to the local level as well as local capacity building to manage the HII over time. The local sustainability of the HII is however highly dependent on the decentralization process to create and strengthen local capacity and to facilitate participation of both local and central actors.

The formal rules and informal constraints constituted by the various entities and their inter-linkages of an organizational field can create multiple contradictory influences on the process of

decentralization and sustainability of the HII. As the current installed base of the HII is embedded and institutionalized nationwide (in the multiple levels and various entities of an organizational field), a realistic change strategy needs to take a cultivation approach. The cultivation process involves gradual change of an installed base of the HII in both institutional and technical aspects through participation and capacity building. It involves gradual change of deeply embedded attitudes, behaviors and norms as well as existing contradictory influences that are incompatible with new changes. Individuals within organizations accept the new norms, rules and meanings of the HII through the process of institutionalization. The new norms, rules, and meanings of the HII are institutionalized as they are integrated into the everyday routines of the local level, and other systems and as are produced or reproduced over time, such as of data collection, reporting, and use of information and computers. Each of these sets of relations is further explained in Chapter 6.

## CHAPTER 4

### **RESEARCH APPROACH**

This chapter describes the research approach and methods adopted as a part of my empirical research in the health sector of the Tanzanian mainland from 2003 to 2005. I first describe the research background and motivation in section 4.1. In the following section, 4.2, I provide details of the research approach, organized into two subsections: Interpretive approach and Case studies. Section 4.3 provides details on the research setting and the field work, while the details of data collection and its analysis are presented in sections 4.4 and 4.5 respectively.

#### ***4.1 Research background and motivation***

My research is based on the Health Information Systems Program (HISP) (Braa, Monteiro & Sahay, 2004; Braa & Hedberg 2002). The adoption of the HISP's technologies, approaches, and ideas started in Tanzania in 2002. The philosophical assumptions of the HISP activities/project/network include action research, participation, and human capacity building. The program is especially focused on supporting the adaptation of an open source software system - the DHIS, inculcating knowledge and skills amongst health workers in computer use and supporting the use of information for local action (Braa, Monteiro & Sahay, 2004, Williamson et al., 2001). As a starting point, a multidisciplinary local HISP team comprised of researchers from public health and ICTs was established. The public health members were responsible for becoming engaged in training and conducting discussions towards improving existing working procedures, understanding the meaning of data and the use of information for action. The ICT members (including myself) were responsible for working with the public health members to customize the software and conduct training on computer and basic application (DHIS) use.

The pilot implementation of the HISP started in two health districts, namely Kibaha and Bagamoyo. The pilot HISP districts were selected by the national manager of the HIS unit at the Ministry of Health simply because they represented a rural area with a large ratio of public health facilities, and were also located close to the city of Dar es Salaam where all the HISP researchers lived and where the MoH is located. Bagamoyo and Kibaha are among the six districts of the Coast Region. Bagamoyo is a small historical district located about 70 kilometers North of Dar es Salaam covering an area of 9,842 square kilometers. It has a population of 230,164 as per the 2002 census and a population growth rate of 3.3%. Kibaha is much smaller than Bagamoyo with an area of 1,630 square kilometers, population of 132,054 and with a population growth rate of 4.4%.

The Tanzania health system organizational structure consists of four levels; health facility, district, regional and national, wherein the district represents the hub for all information flows. At the regional and national levels, the existing paper-based HIS is computerized, but the software in use has been reported to have a number of pitfalls, such as its inflexibility to change and missing several key functionalities (Kimaro & Nhampossa, 2005; Lungo, 2003). However, at the district level, there was

no software to support data storage, processing and analysis. Thus, implementing and customizing the DHIS in the district context and its linkage to the existing national paper-based system was an important goal in the Tanzanian HISP.

In January 2003, I was granted a one year scholarship from the Norwegian Education Loan Fund (Lanekassen) through the Department of Informatics of the University of Oslo to develop a concrete research proposal within the Tanzanian HISP framework. This proposal was to serve as the basis for formal enrolment into the PhD study at the University of Oslo. Consequently, I wrote a proposal entitled “Developing a sustainable district based health information system (DHIS) in Tanzania”. This was submitted to the department in June 2003 and was approved in August 2003. Working within the framework articulated in the proposal, I focused on an in-depth understanding of the problem of local sustainability of HIS and sought to develop appropriate strategies to address this problem. The motivation to undertake the study came from the fact that the success of the HISP depended very much on the prior paper based HIS – the historical legacy system. I thus wanted to examine how the existing technical and institutional contexts shaped the implementation and sustainability of the new computer based HIS. Thus, while working in the pilot sites as a HISP member and a researcher, I conducted various discussions with key actors around the existing HIS, focusing on challenges involved and their underlying reasons. The outcome of these discussions further strengthened my motivation to work together with the HISP team to try to address some of the existing challenges.

As the empirical work progressed over time, I began to understand how the challenges of local sustainability are fundamentally linked to the problem of decentralization of both the HIS and health administration. I, therefore, decided to broaden my research focus to studying also the aspect of decentralization in relation to local sustainability of HIS. For example, I conducted an analysis of work practices around HIS at the health facilities and how these were influenced by the higher levels, for example through supervision, feedback, training, and resource allocation. At other levels (district, regions, and national levels), I analyzed the capacity and authority they had over resources and the different systems through which planning and decisions were made. Specific attention was also directed towards further understanding the processes of design, implementation, computerization, and training around the existing paper and computer-based HIS and the role of the various actors involved such as donors and MoH officials.

In the next section, I present my research approach and methods.

#### ***4.2 Research Approach***

The research approach was based on two key components: an interpretive approach and a case study approach. These are now discussed.

#### 4.2.1 Interpretive approach

Qualitative research can be positivistic, interpretive or critical (Myers & Avison, 2002; Klein & Myers, 1999). Interpretive perspectives attempt to understand phenomena through the meanings and interpretations that people assign to them and their understandings of the social and organizational context. It thus has the potential to produce deep insights into the phenomena such as the processes of IS development and management and how these influence and are influenced by the context (Walsham 1993, 1995a). Interpretive research does not predefine dependent and independent variables, but focuses on understanding the complexity of human sensemaking processes in situated contexts. It assumes that the knowledge of reality is gained only through social constructions such as language, shared meanings, tools, documents, and other artifacts (Klein & Myers, 1999).

In contrast, a positivistic approach focuses on establishing formal hypothesis, quantifiable measures of variables, hypotheses testing and making statistical generalizations from a sample where the phenomenon is studied to a larger population (Orlikowski & Baroudi, 1991). A positivistic approach assumes that the relationship between human and social reality is “independent” and not influenced by the “bias” of the researcher (Orlikowski & Baroudi 1991; Levin 1994). Positivistic studies seek to test theory in an attempt to increase the predictive value rather than developing a descriptive understanding of the phenomena under investigation (Walsham, 1995b). Positivistic researchers tend to ignore that people think and act and are active makers of their physical and social reality (Orlikowski & Baroudi, 1991).

Critical theorists assume that people can consciously act to change their social and economic conditions. They also assume that social reality is historically constructed and that people’s actions are constrained by various forms and structures of social, cultural and political domination. (Klein & Myers, 1999). Critical studies focus on the oppositions, conflicts and contradictions in society and how to eliminate the causes of alienation and domination (Myers & Avison, 2002).

Interpretive research makes the epistemological assumption that reality is subject to multiple interpretations and thus cannot be studied objectively to establish a truth. Interpretive research aims at understanding and analyzing subjective interpretations and their consequences; thus it seeks a relativistic, rather than shared, understanding of phenomena (Orlikowski & Baroudi, 1991, p. 5) based on the assumption that this understanding and analysis is mediated by the researcher (Walsham 1993; Myers & Avison, 2002).

The interpretive approach was adopted in this study to help to understand the socio-technical processes involved in the introduction of the DHIS software from the perspectives of various actors involved. The National Health System administration is comprised of various interconnected hierarchical levels including health facilities, districts, regions and national levels, making it a complex organization shaped by various formal and informal institutions. Also, the interpretive perspective helped me to gain an in-depth understanding of the various formal and informal practices that surround, and are constituted in, the use, analysis and flow of health information from the local to the central levels. It helped to understand the social and organizational context of the health workers

and health managers as they engaged in their routine work and as they mutually interacted (within and across levels).

#### 4.2.2 Case studies

Typically, case studies can be positivistic (Benbasat, Goldstein, & Mead, 2002), interpretive (Walsham, 1993, 1995b) or critical (Hirschheim & Klein, 1994) depending upon the underlying philosophical assumptions of the researcher. To examine the institutional challenges of decentralization and local sustainability of HIS in Tanzania, the research presented in this thesis adopted an interpretive case study approach. Such an approach allows the researcher to investigate systems in particular institutional settings in order to understand the nature and complexity of the processes and actions involved (Myers & Avison, 2002; Walsham, 1995b). Case studies are seen as “appropriate when investigators either desire or are forced by circumstances to (a) define research topics broadly rather than narrowly, (b) cover contextual and complex conditions and not just isolated variables, and (c) rely on multiple and not singular sources of evidence” (Yin, 2002, p. ix).

The complexity of decentralization and local sustainability cannot be examined by placing clear and predefined boundaries around the processes being studied. The processes of decentralization and local sustainability involve various entities of an organizational field involving multiple actors with different interests and logics. A case study strategy was thus adopted to try to understand the research issues from multiple perspectives representing the different stakeholders. It is also concerned with the study of the installed base of the existing HIS and the associated institutional and technological challenges of the introduction of the new system (HISP). Key to this analysis was to understand how the institutional context shapes the processes of decentralization and local sustainability of HIS, and how these play out in the everyday lived experiences of the various actors (Suchman, 1987; Orr, 1996). This understanding then provides the basis to plan, implement and evaluate various interventions. An outline of the case studies conducted is depicted in Figure 4.1

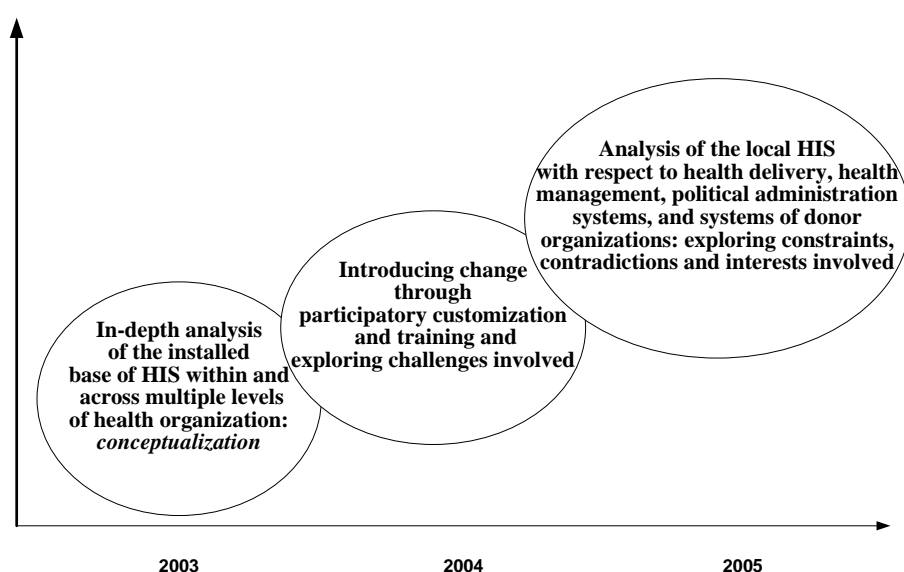


Figure 4.1 Brief overview of the case studies undertaken over a period of three years

The specific research aim was to examine the challenges of decentralization and local sustainability of the HIS in Tanzania. First, an in-depth analysis of the installed base of the existing HIS within and across multiple levels of health care organization was conducted. Second, in order to get a better picture of the constraints encountered such as the poor quality data, I participated in the customization of the DHIS and in conducting training seminars at the district levels. We analyzed the routine health data from the health facilities using the DHIS to generate reports, identify gaps in the data and to encourage the use of information for action. Third, to help answer the “why” questions, for example why data reporting and other resources were untimely, the findings from the first two stages were situated within the overall context of decentralization and its potential influences on HIS related systems. This analysis resulted in a deeper understanding of the challenges of decentralization of HIS within a broader institutional context.

#### ***4.3 Research Setting and Field Work: Multi level approach***

My research was situated within the HISP pilot sites in Tanzania, namely the two health districts of Kibaha and Bagamoyo. Although subsequently the HISP scope was changed to include three more districts in the city of Dar es Salaam, my research remained focused on the initial two HISP pilot districts and their health facilities as well as on regional and national levels. These pilot districts are neighbors and have no significant differences in terms of geography, and infrastructures. The aim was to introduce bottom up changes in these two districts across levels and horizontally across different health programs (mother and child health, expanded program of vaccination, in-patients, diseases of mandatory notification, level of actual stocks, etc.). However, the process of scaling up the activities of the HISP to accommodate these changes has been slow because of various institutional and financial factors involved, particularly related to (the lack of) decentralization.

The field work carried out included the two HISP pilot districts and associated health facilities, the regional level, the national level and the MoH headquarters. The multiple level analyses enabled an understanding of the various vertical and horizontal flows of information, resources, rules, plans, and support. For example, I studied how data was gathered first from the health facilities (clinics, health centers, and district hospitals), and its flow and quality in terms of completeness, correctness and consistency, to the district, the regional and the national levels. I also examined how resources such as data collection tools (such as data registers) were transferred from the national and other levels until they reached the health workers located at the district or health facility level. The aim was to understand the process of vertical and horizontal transfers, the mechanisms by which they took place, and the conditions that influenced these processes.

At the national level, the focus of analysis was on the national HIS unit at the Ministry of Health and its role in the design, development, implementation, training, and support of the HIS. The analysis also included the national policies and strategies on information and ICT use, health sector reforms of decentralization, and training. The role of the donors and how they shaped MoH policies



was another important area of my investigation. At the regional level, the field site included the regional health office with regional health authorities and health administrative staff in which the usability of the current software was analyzed.

The multi level analysis helped to assess and understand the issue of decentralization of HIS at various levels of the health care organization hierarchy, for example to assess how indicators were defined by the national level and then subsequently appropriated by the district and sub-district levels. This approach allowed for an understanding of relationships across and within levels and the challenges and influences involved, for example how the political administrative system influenced the health management and health delivery systems. This also implied getting different views from various actors from these multiple levels and their respective interactions. This analysis resulted in an understanding of the various institutional and technical challenges as well as the underlying reasons for such challenges.

#### ***4.4 Data Collection methods***

The research took place over four time periods: *June to August (2003)*, *January to April (2004)*, *January to July (2005)*, and *September to October (2005)*. The study was conducted through an in-depth review of secondary data including official reports and registers from the different health facilities. In addition, the majority of primary data were collected through semi-structured interviews with key informants (such as health workers, persons dealing with statistics, health managers and planners), and the observation of work practices surrounding the collection, processing, use and transmission of data. A number of photographs of the research sites and of the health workers engaging with data were taken. Many repeat visits were made to HISP pilot districts for collection of empirical data, participating in training seminars, and providing technical support to the users of the DHIS. These visits helped me to obtain a processual view of the issues involved and how they changed over time.

##### **(a) Review of secondary data sources**

The exploratory study started by means of collecting a wide range of relevant technical evaluation reports of the existing paper and computer based HIS, statistical data reports, register books and system manuals of the existing HIS. Also, the analysis of various strategy and policy documents issued by the Ministry of Health and other relevant documents circulated by potential donor agencies, non-governmental bodies and vertical program managers were conducted. While the majority of these documents were in the form of hard copies, there were also some documents which were obtained electronically such as policy documents and HIS evaluation reports. For example, registers books for data collection, aggregation and reporting were obtained in the form of hard copies. These registers were used to collect various types of data related to in-patients, out-patients, drug stock handling as well as documenting community outreach support. These documents were accessed and analyzed in detail with respect to various formal rules related to:

- Design of existing paper and computer- based HIS(e.g. who were involved)

- development of existing paper and computer- based HIS (e.g. which approach was adopted)
- implementation of the paper and computer based HIS ( (e.g. how the software was tested for appropriateness and by whom)
- training of existing paper and computer- based HIS (e.g. what was the training strategy and who was involved)
- use of the existing paper and computer based HIS (e.g. what are formal work procedures of HIS), and
- support of the existing paper and computer based HIS (e.g. how often is support provided and by whom)

In analyzing these documents I realized that in most cases the description of the formal rules of the existing paper-based HIS, for example procedures for data reporting, did not match the reality of the practical setting. Although specific dates were set for the reporting of data from health facilities, data reporting was untimely and some health facilities did not report their data to the district level at all. Thus, in order to understand the performance and constraints of the existing paper and computer-based HIS, I needed to get the practical views of various actors involved and observe how the system operated in practice (at the multiple levels). I employed techniques of semi structured interviews (see more details in the appendixes 9 and 10), discussions, and participant/observations of actual work practices (district and health facilities) to increase my understanding of the existing paper and computer-based HIS and its relation to the institutional context.

### **(b) Semi-structured interviews**

The interviews which I conducted were based on both formal and informal appointments with key respondents such as health workers, persons dealing with statistics and training, system users, vertical program coordinators, HIS managers and planners. Table 4.1 represents a summary of the respondents and their place of work. The semi-structured interviews typically spanned an average duration of one and a half hours. None of the interviews were audio recorded as some of the topics of discussions were considered sensitive by the respondents. Instead, I took rough but extensive notes during the interviews and typed them on a computer later in the evening. A research diary was maintained to document relevant notes over time and some notes were also cross-checked with the concerned respondents. Both Swahili (for health workers at health facilities) and English (health officials at other levels - district, regional and national) were used for the interviews and discussions depending on the choice of respondents: Swahili notes were subsequently translated into English.

At the health facility, the questions primarily related to work practices around HIS and how these were influenced by the higher levels and donors, for example through supervision, feedback, training, and resource allocation. The respondents at the district and other levels above were asked questions related to the control they had over resources and the different systems through which planning and decisions were made. Through this, I tried to understand the relationships between the systems of health management, political administration, and international aid agencies. A specific

focus of the questions was on the participation of the health staff in the design, implementation, and computerization of HIS. This helped to analyze the relationship between the processes of decentralization of the health system and the HIS. In addition, information about the educational level of trainees and the kind of training sessions attended since the inception of the HIS was gathered. The persons working on statistics and managers at the districts and health facilities were also asked specific questions regarding the usefulness and quality of data received, data handling practices, the existing constraints in the HIS and existing strategies to improve the quality of data and use of information. At the Ministry of Health (MoH), I met with senior managers in charge of the HIS to discuss issues of software development, implementation, training, and user support as well as the role played by donor agencies and external developers in these arenas. My interviews with the manager of the HIS unit and the coordinator of the donor supported Health Sector Program Support<sup>2</sup> at the Ministry of Health headquarters provided me with further perspectives on the roles of developers and donors in the development and implementation of the national HIS. For example, I gained insights about how the donor supported the training, procurement of the software and computers, and the design of the paper-based HIS such as forms and reports.

**Table 4.1 Summary of the interviews conducted, broken up by the different organizational levels.**

<b>Working level</b>	<b>Type of respondents</b>	<b>No of respondents</b>	<b>No. interviews</b>
National level (MoH)	managers	2	4
	trainers	3	5
	statisticians and database users	3	4
	Planner	1	1
Coast region	information coordinators (HIS)	2	3
	health secretary	1	2
	database users	4	5
	vertical program coordinators	3	6
Bagamoyo district	HIS and vertical program coordinators	3	9
	Health managers	1	2
	Health secretaries	1	1
	CHMT members	2	2
Kibaha district	HIS and vertical program coordinators	2	6
	health manager	1	1

<sup>2</sup> see details at: <http://www.ambdaressalaam.um.dk/en/menu/DevelopmentAssistance/Healthsector/>  
Accessed August 2006

	health secretary	1	<b>1</b>
	CHMT members	3	<b>3</b>
(7) Bagamoyo health facilities	health workers dealing with data collection and compilation	15	<b>15</b>
	in-charge of health facilities	5	<b>5</b>
(5) Kibaha health facilities	health workers dealing with data collection and compilation	10	<b>10</b>
	in-charge of health facilities	3	<b>3</b>
	<b>Total</b>	<b>66</b>	<b>88</b>

Some of the interviews in Table 4.1 were repeated especially at Bagamoyo and Kibaha and the national HIS unit, during the four different phases of the field work.

In addition to the internal sources of empirical data from key informants working within the health sector, I also conducted interviews with key informants working outside the health sector who have a direct relationship with the existing HIS (paper and computer based) and the health sector. For example, in 2003 I interviewed head of the Tanzania Public Health Association (TPHA). This person was previously worked as the District and Regional Medical Officer, Chief Medical Officer, and also had participated in various technical evaluations of the existing HIS as a researcher in the MoH task force. She gave me her perspectives on the reasons for the poor performance of HIS and details of the design, implementation, training and use processes as well as what she believed could be done to improve the performance of the HIS. Other sources of empirical data of the HIS were two Tanzanian HISP members. One of the members, a doctor and public health specialist, was an employee of the HIS unit at the MoH, during the 1990s' and had participated in all practical processes of introducing both the existing paper and computer based HIS in the country (such as design of paper forms, training, etc.). He also participated in the 2002 MoH Task Force for the evaluation of the existing paper and computer based HIS (see, MoH, 2002). The other HISP member, a public health specialist, had vast empirical experience with the operation of HIS and factors affecting use of information especially at the local level (see, Mwangu, 2003). They provided me with various perspectives on the types of training required and on factors causing poor quality of data and low utilization of information.

I also had some discussions with two staff members of donor funded Tanzania Essential Health Intervention Project (TEHIP) (the project manager, Don de Savigny and his project assistant). The TEHIP<sup>3</sup> is a research and development partnership involving Tanzania's Ministry of Health and Canada's International Development Research Centre (IDRC). TEHIP was established to test innovations in planning, priority setting, and resource allocation at the district level, in the context of the reform and decentralization of Tanzania's health care system. In my discussions with them, I

<sup>3</sup> see details at: [http://www.idrc.ca/en/ev-3170-201-1-DO\\_TOPIC.html](http://www.idrc.ca/en/ev-3170-201-1-DO_TOPIC.html)

wanted to learn about what they were doing, their experiences at the local level, and challenges they were facing at the local level particularly those related to data collection, analysis and use. These discussions were also aimed at potentially creating synergy between the HISP and TEHIP, and how the two groups could work together and share data.

### **(c) Discussions during presentations and training seminars**

The starting point of HISP in the health sector of Tanzania was a presentation that was held at the Ministry of Health headquarters involving the Tanzania HISP team, the national HIS unit members and other stakeholders in the health sector. The main objective of this presentation was to demonstrate the DHIS software and to elicit their opinion about the appropriateness of this software to the Tanzanian system. A number of training seminars were also conducted over time in the two HISP pilot districts. As one of the facilitators, I was engaged in the customization of the DHIS and in supporting computer training by providing the trainees with skills on basic computer use. The trainees involved in these seminars were information coordinators and systems users. Some of these training seminars were organized at the district level and included representatives from the national and regional levels. I also participated in an off-site training program, which was a part of the diploma course in health informatics conducted by the University of Oslo in collaboration with the University of Dar es Salaam. This is a one year program targeted at multiple level information coordinators and health managers in health care administration to improve their skills in aspects of HIS and DHIS use ensuring data quality, information management and analysis as well as to develop skills on information interpretation and computer use. It also involves a five month field work component wherein course participants analyze a particular HIS problem at their own site and develop key practical recommendations on how to solve the problems identified. These trainees are expected to participate in implementation of their recommendations at the end of the course.

During the training seminars, the HISP team tried to create an enabling environment for the sharing of experiences and mutual learning between the HISP team members and the HIS/DHIS users (from the multiple levels of the health administration). These were basically interactive seminars drawing upon participants' domain knowledge and skills, as well as the facilitator's expertise and ideas relating to HIS, computers and public health. These seminars included training on computer skills and basic applications such as word processors and spreadsheet, DHIS (use, data entry and report generations), and concepts and applications related to the use of information for action. The main focus of these seminars was typically on the practical aspects of the DHIS software including data entry, definitions and calculations of key indicators, DHIS installation and configuration, drawing graphs and charts, etc.

These interactive workshops helped to an extent to facilitate dialogue and conversation amongst health staff from different hierarchical levels on particular issues such as how to improve the quality and local use of data. Through discussions with various representatives and students (especially from the two HISP pilot districts and the Coast region), I gained a further understanding of

the perceived challenges relating to the existing HISs such as the reasons for the lack of skills, motivation, timely reporting, and allocation of resources for HIS at the local level.

#### **(d) Observations**

Observations took place in training seminars, presentations, discussions, meetings and at the working sites. A range of observations were conducted in the health facilities for example how data is compiled, aggregated, and reported to the district level. I observed the routines for data collection for local statistics, reporting, and the use of various reporting tools, such as registers and forms. I also observed how health workers prioritized their work related to the provision of health services over data handling and their respective attitudes towards this work. At the district level, I observed supervision procedures and key problems and constraints from the view of district managers and district health management teams. At the regional and national level, I observed the software database and how it was being used.

#### ***4.5 Data Analysis***

Data analysis refers to the various techniques employed to analyze the empirical data collected. In this thesis, empirical data was collected during the course of the fieldwork from 2003 to 2005 through various qualitative methods (interviews, observation, and document analysis), and its analysis was broadly informed by the interpretive approach (Walsham 1993; Orlikowski & Baroudi, 1991). In analyzing the data, I focused my attention on the views, decisions and actions expressed by various respondents at multiple levels of the health sector, concerning the historical processes and assumptions of the design, development and implementation of the new and existing computer and paper-based HIS. For example, how the formal rules of the HIS were developed and introduced in the particular setting, such as relating to the use of data collection tools, indicators, data sets, and software. I also focused my attention on understanding the institutional context and how this influences the current local actions and perceptions of the HIS and information use in general.

The starting point for my analysis of the empirical data was to develop deeper insights into the challenges of local sustainability of HIS, how sustainability could be conceptualized, the conditions that influence sustainability of HIS and how existing challenges could be addressed. I started with the analysis of data related to the design, development and implementation of the existing HIS. Since I also had the responsibility to introduce the HISP project in the pilot sites in Tanzania and make it a success through action research efforts, I also focused on understanding the institutional challenges of HISP in relation to the existing 'installed base' of previous paper-based and computerized systems.

The analysis of the empirical data collected involved identifying various themes. Since interviews were the primary source of data, I tried to link the identified themes with specific quotes from informants. I further described the broad categories of themes, then reassembled material from field notes, reports, and my HISP activities experiences and observations under each of these categories so that they formed coherent topics. To elucidate on these interpretations and themes, my

supervisors and I discussed theoretical concepts that seemed appropriate to understand and describe these aspects.

Prior to doing fieldwork, I had some initial concepts from reading relevant literature on aspects of development, implementation, decentralization, and sustainability of IS. The decentralization and sustainability is interlinked and the existing relationship is embedded in various kinds of infrastructures and institutions. Therefore, I specifically focused on concepts drawn from institutional theory and information infrastructure perspective, which I felt were relevant to shaping my analysis of the relationship between decentralization and sustainability. I identified various key concepts related to sustainability such as decentralization, participation, capacity building, organizational field, institutionalization, cultivation and flexibility. Subsequently, I tried to relate existing challenges to these key concepts, such as how the cultural and organizational context helped or constrained capacity building efforts. The analysis of empirical data helped to delineate some challenges and strategies on human resource capacity building that can contribute to sustainability.

My attention was focused on understanding the challenges being experienced in the routine HIS and ICTs at various levels. Through analysis of these challenges, I was able to identify the institutional challenges that shape the decentralization of HIS. Subsequently, I tried to relate these challenges to various institutional perspectives. The analysis helped to draw some inferences around how processes of decentralization and sustainability of the HIS were interlinked and influenced each other. As I worked on various aspects of the local customization of HIS, I tried to interpret the challenges that I experienced in the various practical tasks at the local level, with respect to participation. For example, I encountered various challenges such as the non-participation of managers in the training sessions, how these were shaped by broader institutional conditions, and how this non-participation shaped processes of HIS design and use. In order to address the challenge of technical capability and changing needs at the local level, I have suggested a “participatory customization” approach (see details in paper 5 shown in the next chapter).

The analysis process proceeded iteratively, involving various and simultaneous activities including reading of relevant literature, informal and formal discussions with my supervisors, faculty and other colleagues, writing research papers and making presentations at international conferences. The written and oral feedback received in terms of review reports helped me to reflect on my analysis, read additional literature, and refine my approach so as to be able to respond to the feedback. This iterative and ongoing process of dialogue between my data, analysis, discussions with a larger research community, and the reading of literature helped me to both sharpen my focus and expand the scope of my data analysis.

The analysis of empirical data contributed to the development of various papers that deal with sustainability and the challenges which shape local sustainability such as participation, human capacity building, and decentralization. At the stage of writing this thesis, the data analysis process was taken to a higher level of abstraction where the attempt was to see how these different components taken together help to develop a broader and more holistic understanding of the local

sustainability and decentralization process. This process of analysis and further reading of the data in relation to other themes led to the development of the theoretical model that I have articulated in Figure 2.1

Walsham (1995b) argues that interpretive case studies can produce four types of generalizations of the results: the development of concepts, the generation of theory, the drawing of specific implications, and the contribution of rich insights. In this case, rather than testing or verifying theories, the objective has been to generalize from the empirical material in both theoretical and practical terms. This includes developing a theoretical perspective to understand the relationship between decentralization and sustainability, extending specific constructs, contributing rich insights, and drawing specific implications. For example, in one of the case studies of this research, an empirical finding concerned the manner in which the system was designed at the central level and transferred to the local level, ignoring the local informal constraints and the necessary skills development. Similarly, insights around contradictory influences and logics of various entities of the organizational field helped to unpack the problem of decentralization.

In conclusion, this chapter has presented the details of my research approach including the research background and personal motivation, and the methods for data collection and analysis. In the next chapter, I present the findings of the articles included in the appendix of the thesis.



## CHAPTER 5

### RESEARCH FINDINGS

#### 5.1 *Research papers included in the Thesis*

The aim of this chapter is to discuss the findings emerging from the research papers included in this thesis. This thesis draws upon eight papers published in conference proceedings and international and peer-reviewed journals. The papers have been published at different stages of my doctoral study and have been written with different co-authors and emphasize different facets of the thesis. The complete list of the papers included in the appendixes of this thesis is as follows:

1. Kimaro, H. C. & Twaakyondo, H. H. (2005). Analyzing the hindrance to the use of information and technologies for improving efficiency of health care delivery system in Tanzania, *Tanzania Health Research Bulletin*; 7(3), 189-197.
2. Kimaro, H. C. & Nhampossa, J. L. (2004). The Challenges of Sustainability of Health Information Systems in Developing Countries: Comparative Case Studies of Mozambique and Tanzania. In. Leino, T., Saarinen, T. & Klein, S. (Eds.), *Proceedings of the 12<sup>th</sup> European Conference on Information Systems (ECIS) on the European IS Profession in the Global Networking Environment*. Turku, Finland.
3. Kimaro, H. C. & Nhampossa, J. L. (2005). Analyzing the problem of unsustainable Health Information Systems in Less-Developed Economies: Case studies from Tanzania and Mozambique. *Information Technology for Development*; 11(3), 273-298.
4. Kimaro, H. C. (2006). Strategies for developing human resource capacity to support sustainability of ICT based health information systems: A Case study from Tanzania. *The Electronic Journal of Information Systems in Developing Countries*, 26(2):1-23.
5. Kimaro, H. C. & Titlestad, O. H. (2005). Challenges of user participation in the design of a computer based system: The possibility of participatory customization in low income countries. In. Bada, A. & Adalakun, O. (Eds.). *Proceedings of the IFIP W.G 9.4-Working conference on enhancing human resource development through ICT*. Abuja, Nigeria. May 2005. pp. 111-122.
6. Mukama, F., Kimaro, H. C. & Gregory, J (2005). Organization culture and its impact in information systems development and implementation: A case from the health information system in Tanzania.' In. *Proceedings of Information Systems Research Seminar in Scandinavia (IRIS 28th)*. August 2005, Kristiansand, Norway. <http://www.hia.no/iris28/Docs/IRIS28-Mukama%20et%20al.pdf>
7. Aanestad, M., Monteiro, E., Kimaro, H., Macombe, E., Macueve, G., Mukama, F., Muquingue, H., Nhampossa, J. L. & Lungo, J. (2005). Strategies for Development and Integration of Health Information Systems: Coping with Historicity and Heterogeneity.

<http://www.ifi.uio.no/forskning/grupper/is/wp/052005.pdf>

8. Kimaro, H. C. & Sahay, S. (2006). An Institutional Perspective on the Process of Decentralization of Health Information Systems: Case Study from Tanzania. *Information Technology for Development (forthcoming)*.

Each of these papers illustrates various insights, ideas and concepts derived from the theoretical analyses of the empirical data. The contents and findings of each paper are summarized as follows.

### ***5.2 Analyzing the hindrance to the use of information and technologies for improving efficiency of health care delivery system in Tanzania***

This paper seeks to address the status of the current information technology (IT) based HIS in Tanzania and to identify major hindrances to the effective and long term use of information and IT in the health sector. The starting point of this paper is that Information Technology has been described as having tremendous potential to improve health services as well as to meet broader developmental goals which have an impact on health. Through the use of IT, the health care sector can potentially plan, monitor and evaluate health services as well as communicate more effectively within and across organizational hierarchies. However, a number of studies have identified various hindrances in achieving this in practice, particularly in Tanzania. Despite the lack of appropriate use of existing IT resources in the health sector, donors and the Tanzanian government have continued to invest in the acquisition of technical resources (such as hardware and software) while placing little emphasis on long term IT training, data management and effective utilization of information. The IT based HIS has continued to remain ineffective due to many factors including lack of culture of information and IT use, inadequate human capacity and lack of strong administrative commitment.

The study was based on a number of semi-structured interviews with health workers at various health facilities, health information compilers and managers as well as through the conduct of participant observation. The findings generally indicate the lack of sufficient skills for information use and interpretation, a weak strategy for human capacity building as well as a lack of a flexible software system. The findings suggest that the peripheral staff is weak in understanding issues relating to the use of information and of the role of the computer based HIS. Health workers typically have weak knowledge and skills to make sense of information and do not have access to appropriate resources (such as training) to analyze and use the data. We have thus argued for the decentralization of resources and authority for the HIS in order to improve skills in the interpretation of data and use of IT. A continuous training and learning environment is also necessary to create and support the cultivation of a culture of information use. However, health managers at various levels of the health system need to show, through practical actions, that the information/data collected is needed and relied upon for the management of health care services. Interaction between levels is also needed in order to enhance learning through proper supervision and participation in joint actions. The need to address issues at multiple levels (through simultaneous top-down and bottom-up participation) is important to

secure an institutional mandate, capacity and ownership. Moreover, the HIS as an information infrastructure, must be designed to be as flexible as possible to allow for the smooth incorporation of new organizational needs and cultural values over time.

### ***5.3 The Challenges of Sustainability of Health Information Systems in Developing***

#### ***Countries: Comparative Case Studies of Mozambique and Tanzania***

The introduction of IT typically comes with the promise of helping to manage scarce resources, increase efficiencies, reduce workload, and increase work productivity. In the context of developing countries, the lure of these promises is magnified given the existing conditions and inefficiencies. International donors, for example the World Bank or/and the World Health Organization, play an important role in shaping this promise because developing countries are dependent on them for both technical and financial resources. Given that IT projects may take a long time to be fully institutionalized, sufficient resources are required to build adequate capacity to support and sustain the project after the withdrawal of donors. Inadequate donor support often contributes to weakening rather than strengthening human resource capacity and effective system design, since it emphasizes the technology itself, often at the expense of the needs of the users. These factors contribute to the design and implementation of unsustainable HISs in developing countries.

This paper builds on two comparative case studies from Tanzania and Mozambique, analyzing the issue of (un)sustainability. Through a comparative case analysis, we identified three sets of relationships as crucial in shaping the sustainability of IT based HISs. These include the relationship between: the Ministry of Health (MoH) and the software development agency; the MoH and the donors; and, the donors and the software development agency. The reasons for the lack of alignment between these relationships, although different in the two cases, are identified to contribute to the unsustainability of the HISs and some specific recommendations are made to support their alignment, and with it, we argue, the sustainability of the system.

In this paper, we argue that sustainability depends on integration of the IT system into the organizational complexities and routine work practices through processes of institutionalization. However the institutionalization process takes time as it demands continuous learning and training and a long term flow of funds to support the activities of the system. The actors (donors, developers, and health care organizations) involved in one way or another with the HIS have varying roles to play either technically, financially or operationally. Moreover, the HIS must meet local needs and be driven by local people for it to be sustainable and evolve over time. Collaboration between the local organizations and donors plays a key role to sustain the changes achieved in the long run since donors have funds, expertise and experience. However, the local organization needs to have control over the system development process in order to shape it to their particular needs. User organizations in developing countries have a shortage of trained manpower, skills and are confronted with constantly changing needs. As a result, donors could play a long-term role, both technically and financially, to assist user organizations to cope with changing demands and to build local capacity. The alignment of

resources, interests and responsibilities of all the actors involved is crucial to avoid the duplication of effort around the HIS.

In order to ensure that the systems developed accomplish their intended purpose, the developers, health care organizations, and donors need to conduct a sustainability analysis and develop a sustainability strategy prior to and alongside processes of system design and implementation. This is necessary to examine the potential individual impacts of the systems and how each actor's responsibilities can be accomplished. This implies that the system should be developed through user involvement and should focus on user needs, whose evaluation and feedback should provide the basis for future improvements to the system. User participation in all aspects of the systems development process is thus crucial, from the initiation, design and development of the system through to its implementation. User participation is also required in order to develop gradual changes in user's understanding and to help the system become institutionalized. Such changes need to be carried out incrementally, enabling users to learn from previous changes and to incorporate new changes that emerge over time. Thus, the actors need to create an environment that enables in-house and external generation and sharing of knowledge within the sustainability strategy framework.

#### ***5.4 Analyzing the problem of unsustainable Health Information Systems in Less-Developed Economies: case studies from Tanzania and Mozambique***

This paper draws its empirical data from two case studies conducted by the author of this work in Tanzania with his colleague in Mozambique. The starting point of this paper is the comment by various IS researchers that a large proportion of donor supported IT based projects developed or implemented in Less Developed Economies (LDEs) end up as complete or partial failures and are largely unsustainable. Notably, a number of intra-organizational and external factors are associated with this problem including inadequate infrastructure and human resources capacity, fragmented donor policy and the absence of a vision to manage the sustainability problem. Accordingly, IT initiatives are often donor driven, top down and hijacked by top managers who (normally) do not have adequate skills but who wield enormous power.

In analyzing the cases through the concepts of sustainability and institutionalization, the article develops key insights towards developing a better understanding of the problem of unsustainability. It is argued that HISs become sustainable if they are institutionalized in the sense of being integrated into the everyday routines of the user organization. However, sustainable HISs need to be not only institutionalized, but they also have to be flexible enough to allow them to be changed as user needs change and to accommodate the evolving needs of the organization. Since the introduction of new HISs is not only a technical change, it requires the cultivation and institutionalization of a new kind of culture where information is valued. Through a comparative case analysis of the HIS development and implementation processes in Tanzania and Mozambique, we identified two sets of relationships - between the Ministry of Health (MoH) and donor agencies and between the MoH and software development agencies - as critical contributing factors to the

unsustainability of HIS. Given this setting, we highlight three key strategies for dealing with this problem of unsustainability: (1) Integration of HIS, (2) local shaping of new cultures, and, (3) the adoption of a cultivation approach to systems development.

### ***5.5 Strategies for developing human resource capacity to support sustainability of ICT based health information systems: Case study from Tanzania***

The starting point of this paper is that ICT based systems are typically introduced in organizations with the promise to help manage resources, increase efficiency, increase work productivity and reduce workload. In the context of developing countries, international donor agencies play an important role in shaping and fulfilling (or not) this promise. However, a substantial body of IS literature points to the problem of unsustainability of ICT projects in developing countries. A key challenge identified through this research is the lack of appropriate human resources with respect to quantity and quality, especially with regard to ICT illiteracy. Thus, this paper emphasizes that human resource capacity building on ICTs in developing countries is an urgent issue of concern, not only for the awareness and use of ICTs but also for ensuring their sustainability. ICTs cannot deliver required benefits over time unless they are supported and enhanced by well skilled and educated human capacity.

Building on concepts of sustainability, ICT literacy and human capacity building, this paper analyzes challenges related to human resources in the context of ICT in the health sector of Tanzania and suggests two strategies to address the problem. ICT capacity building is not static as technology changes over time, requiring old skills to be upgraded to learn new ways of handling information. Also, in addition to technical skills, ICT literacy includes skills for handling and analyzing information and adapting it to the local work context. Building of ICT capacity thus involves cultivation of new cultures including ways of handling and using information, and sustaining them over time. Although ICTs are a necessary condition, to make them sufficient the active involvement of people is required, especially the manner in which they make sense of the information and use it for action. Thus, having appropriate ICT learning and training measures in place is critical for the sustainability of ICTs. Using an interpretive perspective, the case analysis illustrates how to approach capacity building. The analysis revealed two key challenges: lack of appropriate strategies for human resource capacity building including ongoing training efforts; and non- participation of health managers in the ICT implementation and training initiatives.

The health sector is a priority for many international donor organizations given the high burden of diseases in developing countries and the emphasis being placed on ICTs. In this paper I proposed that the problems of weak capacity can to some extent be addressed by pooling resources and combining policies of the various donor organizations and by focusing on cultivating an information culture. Appropriate skilled and educated labor also needs to be developed in the area of information handling and interpretation, ICT use, management, database administration and systems management.

Thus, while donors and local governments can strive to provide financial support, local organizations and researchers can work together to create and implement the necessary training programs.

This paper contributes to the debates on sustainability and ICT literacy by arguing that human capacity building involves more than just the building of basic technical skills but also includes strategic thinking about the meaning and use of information for action. This demands a mix of skills including an understanding of the meaning of data, information and ICTs. The creation of a conducive and adaptable learning environment is thus a priority in order to develop motivated and appropriate human resources. However, this requires joint efforts and long term policies of local governments and donors along with local organizations and university researchers.

### ***5.6 Challenges of user participation in the design of a computer based system: The possibility of participatory customization in low income countries***

In general, participatory design is regarded as an effective approach to systems development. However, user participation is associated with certain contextual assumptions, having its origins in the West, which are not always applicable in the context of Low Income Countries (LICs). The initial technical capability of users, their motivation and desire to participate, as well as the general availability of resources and long-term support mechanisms are often taken for granted in the West, but in many cases are not present in the context of LICs. Furthermore, participatory approaches in Western settings are influenced and driven by social-political targets such as work place democracy and local empowerment, and are often backed by strong and well organized trade unions; factors often not present in LICs.

However, in the absence of such factors in LIC settings and where the intended users have limited computer skills, the strategies for participation need to be necessarily different. In a LIC setting, it is hard for lower skilled users to understand the relationship between systems design and a running application on the computer, thus limiting their motivation to participate in the mysterious design process. Given such a context, developers need to find more context-sensitive approaches that do not demand the same kind of basic technological understanding that is taken for granted in the Western context. In such a setting, we argue for a focus on the process of participatory customization, where the users in collaboration with the developers adapt an already developed or partly developed system to meet their local needs. Empirically, the process of participatory customization is analyzed through the study of the processes of customization of the District Health Information Software (DHIS) in two pilot health districts in Tanzania. These processes are then compared with similar efforts in other HISP nodes such as Cuba, India, Mozambique and South Africa.

The participatory customization process can also be understood as a learning-by-doing process where the users learn about basic computer use and application-specific features, while at the same time contribute to the customization of the system. In the Tanzanian case, customization and training were often done in parallel, in collaborative sessions at the workplace involving both users and developers. Thus, by learning from hands-on experiences with the application, some users became

local experts and extremely important participants in the continuous process of customizing and improving the functionalities and use of the software. Given that most users had no previous experience with computers, training in basic computer use was a necessary first step in this customization process, which had to account for various social, economic, and political factors. We identified several challenges that limited the outcome of the user participatory process such as the lack of motivation, weak political support, work overload, idiosyncratic criteria in selecting trainees, and a lack of basic computers skills.

### ***5.7 Organization Culture and its impact in information systems development and implementation: A case from the health information system in Tanzania***

In this paper, we report from the research conducted in Tanzania to identify organizational factors that affect the HIS. This paper was intended to answer the question: How does an organizations culture facilitate or limit the HIS development and implementation processes? The case study is carried out within the large-scale open source software research and development program, called HISP. In this paper, we analyze the HISP initiative from an organizational perspective using concepts from Structuration Theory. The theory is used to explain some of the meanings, norms and issues of power experienced during the early phases of the HISP implementation, and to use them to understand the potential for change. Thus, the key conceptual approach of Structuration Theory helped analyze the actions of the health workers in relation to the social structures within which they are embedded.

The findings suggest that many of the problems in the development and implementation of the HISP are not of a technological nature but concern organizational issues such as those related to culture. For example, the working practices that surround the collection, storage, analysis and transmission of routine health data throughout the health care administrative hierarchy are often in tension with the situational, individual and organizational conditions, which together are conceptualized as organizational culture. The study reveals how the HISP activities and norms in Tanzania are faced with conflicts surrounding the lack of resources and motivation. At the same time, while the Ministry of Health is open to change, it has limited resources due to its dependence on donor support, and associated issues of power asymmetries. This study emphasizes the significant influence of organizational culture on HIS development and implementation, especially related to issues of power.

### ***5.8 Strategies for Development and Integration of Health Information Systems: Coping with Historicity and Heterogeneity***

The starting point of this paper is that health is crucial for development and that well-working HISs are required for supporting health management. However, establishing working HISs in developing countries is truly a challenge. Moreover, strategies for the development and integration of large and growing collections of IS escapes simplistic recipes. This is a pressing practical problem globally, as well as an under-researched area within the IS field. The paper aims to contribute to the understanding and development of such strategies by underscoring two core dilemmas: (i) the

conservative influence of historically accumulated and institutionalized practices, technologies and perceptions (dubbed as the ‘historicity’ of information systems); and, (ii) the poor integration and increasing fragmentation across the collection of information systems (dubbed as the ‘heterogeneity’ of information systems). The empirical underpinning for our analysis is an action research project, the HISP, which aims at improving existing sub-optimal health information systems in developing countries. The HISP provides a particularly poignant illustration of the challenges related to the historicity and heterogeneity of information systems as these are implicated in the politico-historical context. Our empirical material is a cross national comparative analysis of the current reporting systems for administrative health data in Mozambique, Tanzania and in the state of Andhra Pradesh in India.

Due to the donor- and aid-dependent economies of most developing countries, there are often other specialized health care programs e.g. targeted towards specific diseases like malaria, tuberculosis and HIV/AIDS. These programs usually have their own reporting systems, which over time results in a disintegrated and heterogeneous collection of systems. The challenges associated with attempting to change such large-scale, heterogeneous and fragmented systems involve complex dilemmas. As the current information systems are embedded and institutionalized nationwide, a realistic strategy needs to take a phased approach whereby present systems are gradually integrated into the environment. In the case of donor-supported and -managed programs, the national health authorities may not even have the required power to intervene. Thus the existing reality cannot be ignored or done away with, whether it be the information systems, the institutions or the work practices. Analytically, we draw on recent socio-technical conceptualizations of large, integrated systems - so-called information infrastructures - especially through recent elaborations in the theoretical foundation in actor network theory (ANT). The development strategy we suggest emphasizes an evolutionary, ‘cultivating’ approach while at the same time accepting that there will always be a certain level of non-integration (often perceived of as ‘mess’).

### ***5.9 An Institutional Perspective on the Process of Decentralization of Health Information Systems: Case Study from Tanzania***

The analytical focus in this paper is on the adoption of decentralization processes around Health Information Systems (HISs) which are ongoing in various developing countries as a part of health sector reforms. Donor communities in particular have often insisted on such decentralization as a means to enhance the effectiveness and sustainability of health systems. In this paper, it is argued that the decentralization of HISs needs to be considered together with health care delivery in order for it to be effective. Decentralization of health systems focuses on the transfer of decision making, planning and resources from the national to the district and sub-district levels. Decentralized health systems require reliable information and appropriate human capacity to manage the HISs and use information for local action. However, the goals of decentralization of HISs are not easily achieved because of the complexity of the institutional context in which the decentralization is being carried



out. HISs operate in a historically situated, complex, multilevel and interlinked bureaucratic structure consisting of a multiplicity of administrative, health care, and political systems, typically operating in a top-down and hierarchical fashion. The top-down structure often contributes to failures of various reform efforts.

Drawing upon various concepts from institutional theory, we analyze the attempts and processes to decentralize the HIS in Tanzania. We identify three key sets of institutional influences on the HIS originating from the political administration, health management and health service delivery systems. Through an ongoing empirical analysis, we identify the gaps between the formal rules that govern the reform process and the informal constraints which operate on the ground and “keep the show going.” The existence of the gaps between these formal rules and informal constraints, contributes to the ineffective results obtained through the reform process. We also identify some contradictory influences of the three identified systems (political administrative, health management and health delivery) on the HIS. For example, the districts apart from using the nationally designed data collection forms tend to develop their own local informal forms to cater to specific information needs, since they do not have sufficient authority to incorporate changes to the existing official registers. Although, the health care administration is in theory decentralized, the practice reflects a deeply entrenched and hierarchical top down structure. Moreover, health facilities are grossly understaffed and overloaded with clinical tasks at the expense of the HIS, and have limited local administrative and political legitimacy. Consequently, norms, rules and meanings associated with the HIS are not fully institutionalized to obtain the required legitimacy. Moreover, most vertical program managers do not trust the HIS since they were not consulted in the design process, making the HIS further lose its wider legitimacy.

We argue for the need to develop both vertical and horizontal alignments through participation as an approach to address the identified gaps. At the level of vertical alignment, the district is the focal point for the aggregation of data and its circulation across the different levels. For the HIS to be locally effective, it is not sufficient for it to be only vertically aligned but also requires horizontal alignment with the other systems (health management, political administrative and health care delivery). These institutional systems are operationally dependent on the HIS and are thus intertwined in its practices. Effective enforcement mechanisms created horizontally can also contribute to shaping the existing gap between the formal rules and informal constraints. Horizontally arranged collaborative initiatives, can help overcome some of the existing constraints imposed on the HIS.

### ***5.10 Synthesis of findings***

In summary, the findings are related to: 1) the lack of overlap between the imposed formal rules of the HIS and the existing local informal constraints – this is due to the lack of skills around the HIS and information use, weak strategies for human capacity building, the misalignment of interests between key actors, and a top down style of management which creates a strong dependency on higher levels for guidance and resources; 2) the lack of a wider legitimacy of the existing HIS – this is due to its

centralized control, inefficiency, and inflexibility affecting its further improvement as well as the lack of local ownership and participation; 3) The existence of contradictory influences of the various entities of the organizational field comprising the institutional systems – political administrative, health administrative, and health delivery systems and the system of donor support. Furthermore, the efforts to implement the existing HIS have not been adequately aligned with similar work practices and institutions of the systems making the HIS inefficient and thus unsustainable. Consequently, the donor supported vertical programs targeted towards specific diseases have their own parallel reporting systems which contribute to overburdening an already busy health staff, and thus undermine overall decentralization efforts.

Thus, the papers included in this thesis elaborate on four key themes: the influence of the organizational field (informal constraints, formal rules and contradictory influences of the various entities of the field) on decentralization and sustainability efforts, the role of participation and capacity building in decentralization and sustainability, and decentralization and sustainability as a process of institutionalization and cultivation. These themes were derived through the iterative analysis of the empirical data using various concepts drawn from institutional theory, information infrastructure perspective and various IS and public health literature. For example, I identified various key concepts related to sustainability and decentralization such as participation, capacity building, organizational field, institutionalization, cultivation and flexibility and tried to relate the existing challenges of decentralization and sustainability to these concepts. The four themes taken together provide the conceptual basis to address the two research questions posed in the thesis: i) How can the relationship between decentralization of health systems and HISs, and sustainability of HISs be theoretically better understood? ii) How can decentralization processes be conducted in a way that better enables the development of sustainable HISs?

The **first research question** concerns understanding the relationship between decentralization of health systems and HISs, and sustainability of HISs in the context of the PHC sector in Tanzania. The understanding of such a relationship is crucial to improve the efficiency of PHC and the performance of the HIS since both are mutually dependent. A HIS is enabled and constrained by social, cultural and organizational structures in the form of formal rules and informal constraints as well as the actions of the health staff in the health system. The HIS is linked to various infrastructures and institutions related to the health delivery, political, and health administrative systems within and across multiple levels which together contribute to create conditions for its (un) sustainability.

The organizational field shaping the HIS consists of the health care delivery system, health management system, political administrative system, and a system of donor support. The formal rules and informal constraints constituted by various entities of an organizational field create multiple institutional influences in the operation of a HIS. These influences are exercised at the district level or from higher levels through various forms and activities such as the development of health plans, reporting of data, or the conduct of supervision and support. As shown in paper 8 above, these influences are contradictory and existing weak linkages between entities of an organizational field

within and across levels contribute to create a lack of overlap between the formal and informal constraints. This can potentially make the HIS unsustainable and impede change processes. In Tanzania, the political administration system shapes the performance of the HIS in many ways; for example, through insufficient and untimely disbursement of funds, activities such as the supervision of health services and the reporting and collection of routine information, are constrained. Simultaneously, supervision and reporting routines within the HIS depend on the effectiveness of both the health management teams at the district level and health workers at the health facilities. Donors, on the other hand, through their financial strength, tend to specify the types of data they would like to be collected and provide separate incentives, thus influencing the HIS at all levels. Thus, various entities of an organizational field in conjunction significantly influence how the HIS operates and is sustained.

The decentralization of the HIS involves transferring management and planning of the HIS, resources, and responsibilities for capacity building from the central to the local levels. This needs to be accompanied by local institutionalization and cultivation of new roles, structures, responsibilities, meanings, technical procedures for the production of data and budgets. Doing this ensures that the HIS becomes part of the existing normative and cognitive systems of local health delivery, health management and political decision making. Thus, the HIS needs to be embedded in the routines of various entities of an organizational field within the decentralized political, administrative and fiscal administration.

However, the process of institutionalization and cultivation of HIS is influenced by the embedded informal constraints, formal rules, and existing contradictory influences in the entities of an organizational field within and across multiple levels. The alignment of interests, roles, and responsibilities between various actors involved is fundamental to sustain the changes achieved in the long run by addressing emerging needs, providing required incentives, and building required capacity. The fact that the sustainability of the HIS depends on its integration into routine work practices of various entities of the organizational field with various actors implies that the institutionalization process takes time and demands continuous learning, training, and the flow of resources. In the current system, despite formal rules to support the implementation of HIS, empirical findings indicate the dominance of informal constraints at the lower levels and misalignment of interests among the actors involved. Centralization of HIS activities contributes to this situation of imposed rules that are divorced from local realities and needs.

Decentralization and sustainability are interlinked but their relationship is complex as it is embedded in various kinds of infrastructures and is influenced by various institutions in the organizational field. The decentralization of HIS demands not only a regulatory transfer of responsibilities, resources and decision making closer to the point of health service delivery and management, but also the need to adopt a process of cultivation and institutionalization of a different kind of cultures and rules that accompanies the system through local capacity building . The HIS becomes sustainable when it is fully institutionalized in the sense of being integrated into the everyday routines of the existing entities of the organizational field within and across levels. The current HIS in

Tanzania was implemented following a top-down approach, ignoring local informal constraints, thereby contributing to its unsustainability. This unsustainability is evident through the presence of poor data quality, lack of ownership, a weak culture around data analysis and use and lack of incentives.

The **second research question** concerns how decentralization processes can be better aligned to enable the development of sustainable HISs. The organizational field has been described as consisting of various entities (such as international agencies and the district council) comprising the three institutional systems – political administrative, health administrative, and health delivery systems. The institutional influences originating from these systems impact the sustainability of the HIS as well as the efforts to introduce reforms. We have seen how the informal and formal constraints relating to the HIS are intertwined with other institutional systems (health care delivery, health care administration, and political administration). The lack of overlap between the formal rules and informal constraints of the HIS are caused not only by the hierarchical nature of the health care organization but also by the weak inter-linkages between the different institutional systems within the same level. This gap needs to be filled through effective mechanisms of enforcement and the building of collaborative linkages at horizontal levels. Creating these mechanisms is however very complex as it involves political, administrative, and fiscal processes where each has independent governance systems.

A key implication from the empirical analysis is the need to develop both vertical and horizontal alignments, in both the domains of the formal rules and informal constraints. The existing technical and institutional installed base, cannot be ignored or done away with, whether it be the institutions, the fragmented collection of information systems or the legacy systems. These systems constitute the existing practices which have an impact on the HIS and due to their established legitimacy, cannot be changed rapidly. Thus, a realistic strategy for change and the alignment of interests needs to take a cultivation approach where the HIS is gradually integrated into the various entities of the organizational field through open-ended processes of socio-technical negotiations and bottom-up and top-down participation. In the practical setting, where peripheral staff have limited skills in the HIS, there is a need to put extra effort and resources into learning, training, and the creation of appropriate procedures and local capacity for the sustainability of HIS.

At the level of vertical alignment, the district is the focal point for the aggregation and circulation of data across the various administrative levels. A sustainable district HIS is fundamental for the generation of locally relevant information to support PHC and the creation of local capacity, authority and ownership - items currently lacking in Tanzania. The district health system is not fully linked and institutionalized with the HIS, which inhibits the development of PHC around the aims of the HIS. The HIS constantly relies on the higher levels for the formal resources, but continues according to the local informal constraints due to limited local ownership of the reform process, a lack of incentives and administrative commitment as well as a lack of sufficient skills for information use, interpretation and computer use. These factors have led to weak enforcement mechanisms which

contribute to magnify the gap between the formal and informal domains. Consequently, norms, rules, and meanings associated with the HIS are not fully institutionalized to obtain the required legitimacy, trust, and benefits. The legitimacy of the HIS can only be encouraged through participatory design (Puri, 2003; Lines, Andersen & Monteiro, 2003) and negotiations between various stakeholders (such as coordinators of vertical programs) related to the appropriateness of the system. Both of these mechanisms have been largely absent in the Tanzanian case.

For the HIS to be locally effective, it is not sufficient that it is decentralized - it must also be horizontally aligned and institutionalized with the other systems (health management, political administrative and health care delivery) at the local level. The alignment of these systems can create effective enforcement mechanism which potentially can contribute to reducing the existing gaps between the formal rules and informal constraints. When the actors in the entities in the organizational field do not work as a team, there are detrimental effects on the HIS. Thus, there is a need to harmonize the operations of these entities (both horizontally and vertically) with the HIS so as to create substantive bottom-up planning and decision making processes. In Table 5.1 below, a summary of the two research questions posed in this thesis is provided.

Research Question	Answers to the Research Question
i) How can the relationship between decentralization of health systems and the HIS, and sustainability of HISs be theoretically better understood?	Decentralization of a HIS implies a regulatory transfer of resources, planning, and authority for the HIS, and the implementation of processes for the building of local human capacity for the interpretation of data and use of information and ICTs to the local level. The institutionalization and cultivation of a HIS into local routine work practices of various entities of the organizational field at the local level is arguably considered useful to make the HIS sustainable. However, the decentralization processes of the HIS and its local sustainability are interlinked, and their relationship is complex as it is embedded in various kinds of infrastructures and institutions in the organizational field. The three institutional challenges originating from entities in the organizational field impact the local sustainability of the HIS as well as the efforts to introduce new changes. These challenges are: contradictory influences; lack of overlap between the formal rules and informal constraints; and lack of wider legitimacy of the HIS.
ii) How can decentralization processes be conducted in a way that better enables the development of	The district health systems require reliable information and appropriate <b>human capacity</b> to manage the HIS and use information for local action. Sustainability of the HIS depends on its integration into the complexities and routine work practices of the health delivery systems. This <b>institutionalization</b> process requires both cultivation and the vertical and horizontal alignment of interests and resources through participation to

sustainable HISs?	address identified gaps between the formal rules and informal constraints, to resolve existing contradictory influences, and to create wider legitimacy. <b>Vertical alignment</b> entails decentralization of the HIS from the central level to the district level. <b>Horizontal alignment</b> entails the creation of horizontal linkages between entities of the organizational field within the district level. For example, by combining resources and policies to deal with weak local capacity and fragmentation of HISs, and to develop ways of shaping new cultures. <b>Participatory processes</b> involve the alignment of interests of actors involved, the customization of flexible systems, as well as the conduct of training to build required local human capacity. Building human capacity involves new ways of handling and using information, and sustaining HISs over time. The skills required, go beyond basic technical skills and include strategic thinking about the meaning and use of information for local action.
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Table5. 1. Brief answers to the research questions posed by the thesis

In the following chapter, a theoretical framework has been proposed as a means to further understand and analyze the relationship between decentralization of health systems and the HIS, and sustainability of HISs.

## CHAPTER 6

### ***IMPLICATIONS AND CONTRIBUTIONS***

In this chapter, the contributions related to both the theoretical and practical aspects of the research are presented. The basis for the contributions comes from my theoretically informed analysis drawing upon institutional theory framed within an information infrastructure perspective. I started this research guided by the following two research questions. 1) How can the relationship between decentralization of health systems and HISs, and sustainability of HISs be theoretically better understood? 2) How can decentralization processes be conducted in a way that better enables the development of sustainable HISs? In answering these questions (in the following two sections respectively), the key theoretical and practical contributions of the thesis are highlighted. This chapter is structured in two main sub sections - the theoretical and practical contributions respectively.

#### ***6.1 Theoretical contributions***

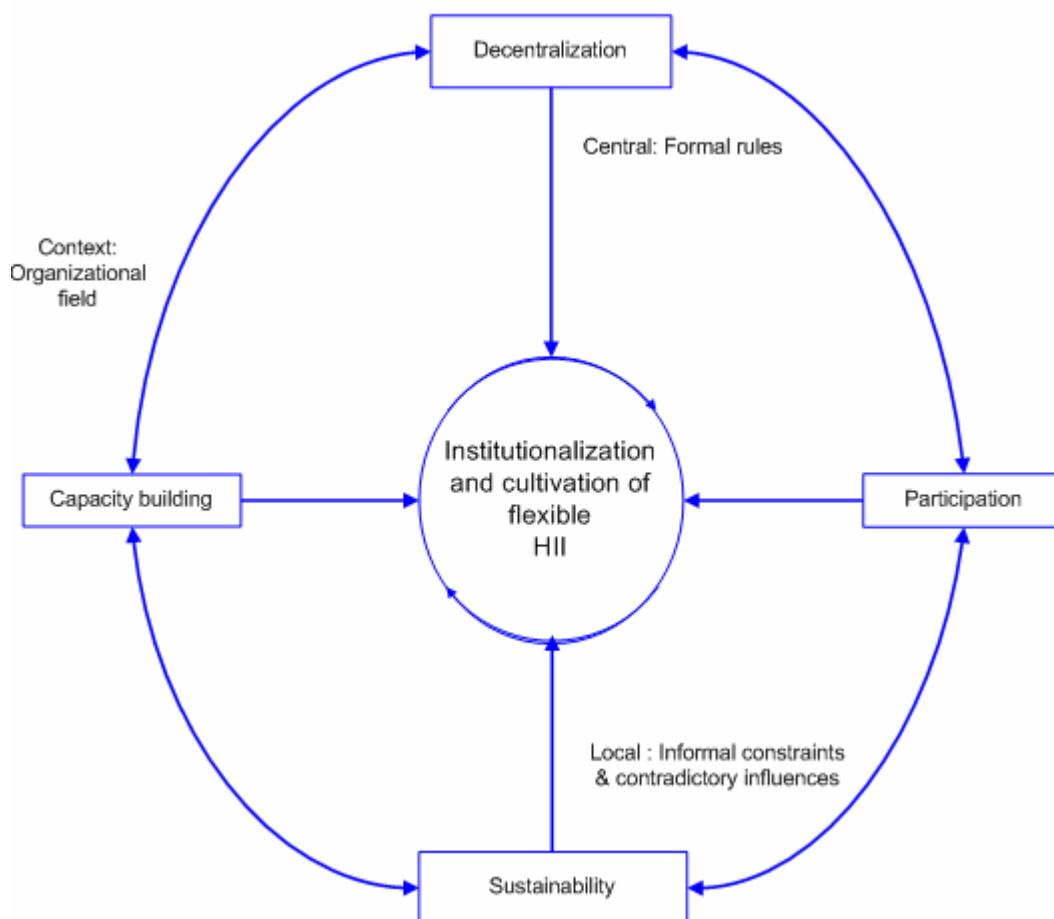
This thesis has made the following two key theoretical contributions:

- A perspective to analyze the relationship between decentralization and sustainability has been developed
- A contribution has been made to debates around “sustainability” and “decentralization” in the context of public health and IS

In the following subsections, each contribution is elaborated upon.

##### **6.1.1 A perspective to analyze the relationship between decentralization and sustainability of HISs**

This perspective is developed drawing primarily upon theoretical inputs from the information infrastructure perspective and institutional theory. From the disciplines of IS and public health, I have tried to understand the nature and characteristics of a decentralized HIS. Additionally, I have drawn on institutional theory to understand the institutional nature of the installed base of a HIS and how it enables or influences change processes. Specifically, I have draw upon notions such as informal constraints and formal rules, organizational field, and legitimacy, and relate them to processes of stability and change. These conceptualizations have enabled the development of a deeper understanding of the complex nature of institutional change within a public health context. From the field of information infrastructure, I have drawn upon key notions of flexibility, installed base, and cultivation, to help make sense of the empirical material, contributing to the development of the theoretical framework that was presented in chapter 3 (see figure 3.1) which is now briefly described.



The relationship between decentralization and sustainability is seen as embedded in various kinds of infrastructures and organizations with their respective institutions, constituting what is called an organizational field. Each level of the health care organization is also constituted by different institutionalized practices and cultural rules and norms, and the availability of infrastructural resources that enable or constrain the decentralization and the sustainability of the HIS. In the construction of the analytic perspective on the processes of decentralization and sustainability, I have elaborated upon the following four sets of relationships, and their interrelations: how decentralization and sustainability are interrelated, and their mediation through participation, how decentralization and sustainability are mediated through capacity building, and how decentralization and sustainability are influenced by the organizational field. Each of these sets of relations is now explained.

### 1. Decentralization and sustainability

This relationship emphasizes the interdependence between processes of decentralization and the local sustainability of a HIS. In most developing countries, HISs are characterized by large amounts of data collection with minimal use to support local action (WHO, 1994; Lippeveld, 2001; Heywood & Rohde, 2000; Sandiford et al., 1992), a lack of ownership, limited resources, and weak human capacity, especially at the local levels. All these factors contribute to the unsustainability of systems. Contemporary reform efforts during decentralization seek to address these asymmetries, but



paradoxically, these conditions need to be in place to enable decentralization. The explicit focus on this relationship helps to emphasize this dilemma and the inherent challenges it brings forth.

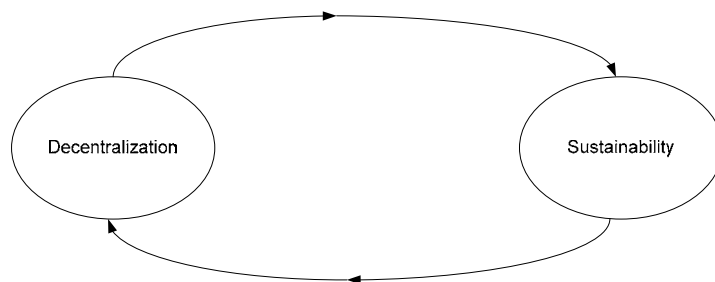


Figure 6.1 interdependence between sustainability and decentralization

An institutional perspective helps to develop a deeper understanding into the nature of this dilemma since normative and regulative frameworks need to be modified and re-constructed to fit into the local setting (Scott, 1995) and since cognitive frameworks cannot easily be imposed on local individuals. The health workers' actions and behaviors are constrained by their limits in information processing capabilities, and changing this requires modifications of existing formal structures and behaviors. However, such adaptations take time to be understood, accepted, and routinely applied (North, 1990). While formal rules may be easily changed as a result of political pressures, changes in norms and beliefs, which are historically shaped, often take time as they require redefinitions of the existing informal constraints. Decentralization processes potentially can support these redefinitions through the provision of resources and capacities to mandate change and sustain them over time. Decentralization involves the transfer of various political, financial and administrative resources and functions to the local level, which potentially can contribute to the creation of a conducive environment to support the sustainability of a HIS. However, such decentralization is fundamentally dependent on the presence of effective information systems to contribute to a more effective, improved, and equitable provisioning of health services by incorporating local accurate information in decision making (Parry, 1997).

Although decentralization can support sustainability, the very factors which contribute to unsustainability undermine decentralization efforts. These factors concern the lack of participation, poor human capacity, and multiple and contradictory influences coming from the organizational field. The introduction of a HIS at the local level typically follows a top down approach where the peripheral staff are often not involved in the design and development process, and are not in the position to influence decisions. Moreover, once such systems are implemented, appropriate strategies are often not put in place to develop local capacity to use the systems or utilize the information generated for local action, leading to their unsustainability. Since such systems fail to meet the needs and interests of health services, this gives rise to further contradictions. For example, the inefficiency of the national HIS in Tanzania has forced various vertical programs to collect their own data, which further contributes to the fragmentation and inefficiencies of the HIS. This creates a vicious cycle of further weakening the local capacity and with it a reinforcement of the need for a top down approach which is in contradiction to decentralization efforts.

Typically, the goals of decentralization of HISs are not realized in practice. HISs tend to be controlled centrally while demanding massive data collection and upward reporting from the local level, but with none or very limited use of the information at the local level (WHO, 1994; Lippeveld, 2001). The demands for data rely on formal rules to serve the interests of higher level bureaucrats while de-emphasizing the local informal constraints. The formal rules are not fully institutionalized into the work practices at the point of service delivery (Piotti et al., 2006). At the local level, the HIS is shaped by various informal constraints that tend to counter the imposed formal rules. The limited value attached to data issues are reinforced by informal norms of the HIS, where data collection is viewed as a bureaucratic task, despite what the formal rules mandate (Chilundo & Aanestad, 2004; Piotti et al. 2006; Mosse & Sahay, 2003). The lack of overlap between the formal and informal constraints potentially tends to create a weak culture around data analysis and use (Piotti et al., 2006) and makes the HIS ineffective and unsustainable. A top down hierarchical structure and ineffective mechanisms of enforcement also contribute to the lack of overlap (Kimaro & Sahay, 2006). This creates a mismatch between the local informal constraints and new meanings arising from the imposed formal rules (Valkow, 2003). An operational HIS at the local level thus continues because of its dependence on the higher levels for resources and sanctions, but does so according to the local informal constraints.

The decentralization of a HIS must take into consideration local institutional factors that influence local sustainability of the HIS, such as the authority for planning and decision making. For example, an authority that can mandate that all reports should be generated through the district HIS and not through various vertical programs, and provides for specific budgets and human and other capabilities to strengthen the HIS structure. The local sustainability of the HIS is thus highly dependent on the decentralization of a HIS as it seeks to create and strengthen this local capacity. Creating this local capacity requires changing deeply embedded attitudes, behaviors and norms and creating local legitimacy. Thus, the decentralization and sustainability of a HIS involves cultivating and institutionalizing a flexible HIS, through participation and capacity building.

## **2. Decentralization and sustainability; mediation of participation**

The decentralization and sustainability relationship is mediated by processes of participation. Participation reflects the relation between the planners and developers on the one hand (typically located at the MoH), and the users and implementers on the other hand (typically located at the sub-district level). The decentralization emphasizes the need for the system to be managed locally and thus enabling local service delivery and participation. Decentralization of the HIS through increased local level participation is expected to contribute to a more sustainable HIS.

The introduction of new HISs at the local setting is often accompanied with new formal rules which often collide with existing informal constraints at the local level. The local informal constraints are represented by dominant values, beliefs, norms, and practices already institutionalized at the local level. The consolidation of these social institutions and the relationships between the local and central

level depends on the HIS design and implementation approach employed (Valkow, 2003). An appropriate approach is certainly required to cope with existing differences between the local and central levels and that provide room for negotiations and re-construction of new rules and norms coming with the system to fit with the existing local setting. The incompatibility between the existing informal constraints and new formal rules often can threaten performance of the HIS (Piotti et al. 2006). User participation in IS design (Schuler & Namioka, 1993; Puri, 2003) has historically been considered to be an important approach to alignment between social structures and related processes (Valkow, 2003). User participation is a process through which the translation of new rules and meanings is accomplished during the design, development, and implementation stages of the system. Table 6.1 below illustrates the four types of participation during the life time of the HIS that have been proposed based on the empirical analysis of the development and implementation of the existing computer-based HMIS in Tanzania (see Kimaro & Nhampossa, 2005) as well as the analysis of processes of customization of DHIS in Tanzania (Kimaro & Titlestad, 2005) and other countries (Braa & Hedberg, 2002; Braa, Monteiro, & Sahay, 2004). These are: user representatives, prototyping, participatory customization, and ongoing consultation.

<b>Phases of HIS</b>	<b>To Do task</b>	<b>Locus of control</b>	<b>Participation</b>
<i>Design</i>	System specification	Central	User representatives
<i>Development</i>	Coding	Central	Prototyping (with user representatives)
<i>Implementation</i>	Customization	Local	Participatory Customization
<i>Post implementation</i>	Technical Support	Local + Central	Consultation
	Updates	Central	Prototyping (with User representatives)
	Revisions	Central	Prototyping (with User representatives)

Table 6.1 Continuous processes of participation between central and local levels

Table 6.1 demonstrates that at different phases of the life cycle of the system, the participation process may be different. Initially during the system specification stage, participation should involve the key user-group representatives (Avgerou & Cornford, 1993) from various levels, systems and other stakeholders to emphasize their needs, interests and requirements. Based on the outlined system specification, the developer under the central level control should develop the system and conduct regular prototyping of system to the user representatives. Prototyping is a way of capturing functional and interface requirements of end users of the system. It allows evaluation and discussion of the design by various user representatives as system development progresses and it provides better understanding between intended users and the developer (Avgerou and Cornford, 1993). The intended users feel that they are positively and practically involved in the development process.

The prototyping process need to result in a flexible and easily customizable system since the requirements of health care organization are likely to change over time as new health programs and indicators emerge and new policies are developed. The multiple levels of health care organizations need to incrementally adapt the system to their emerging needs by modifying it or adding to it new functionalities (Avgerou and Cornford, 1993). The flexible customizable system developed under central control should then be customized at the local level with its intended users, to meet their

practical local needs and interests. This participation process is termed participatory customization. The participatory customization approach implies that the developers initially work closely with the intended users, thereby enabling the users to gain better practical control of the customization process. By initially being guided in the local customization process and collaborating with the developer in a learning-by-doing process, the intended users can develop the ability to continue with the customization processes in the future. A flexible customizable system is recommended to enable the intended local non-technical users to better learn and participate in the customization process, and concretely view the changes in the system. The intended users learn by practicing and doing, gradually building up use and technical skills and thus increasing their ability to continue with the customization process themselves or with limited consultation of the central level during post implementation. Further consultations and prototyping from the central level are intended to provide technical support, software/tools revisions, and updates.

The local and central levels of the health care administration, though interlinked, represent rather different technical, political, and institutional contexts. Given these imbalances and a lack of basic computer system skills at the local level, systems design-from-scratch during the development cycle is extremely difficult and contradictory. Given such a context, in order to engage in participation processes with the peripheral staff, the developers and planners need to find more local context-sensitive approaches that do not demand familiarity with computers and application systems that the developer would take for granted in a Western context. Heeks (1999) explores the effect of participation in developing countries and points to several factors limiting the value of participation. One such example is the case where participation is not really participation, where the culture and politics in an organization prevent participative outcome. Similarly, in Tanzania, we identified several factors limiting the outcome of the user participation such as the lack of motivation, weak political support, work overload, idiosyncratic criteria in selecting trainees, and a lack of basic computers skills. Despite these factors, participation of peripheral staff in the system design and implementation is crucial to develop necessary capacity to use and change the system when future needs arise and to develop local ownership and benefits of the system. The lack of local ownership and capacity of the HIS can lead to unsustainability or failure of the system. Puri (2003) has argued for the need to draw upon local knowledge and integrate it with the more formal and scientific knowledge related to the technology and application domain. Similarly, HIS related reform efforts need to take various knowledge such as related to public health, informatics, and demography into account.

Although, decentralization aims to transfer authority and resources for local capacity building, it can also be used as a way to widen and increase the scope of participation processes. However, the aims of user participation need to go beyond mere participation of peripheral staff in design to also incorporate learning (Bødker et al., 1987, Tollmer, 2001). Typically, a successful user participation process requires users with certain technical skills and the presence of a cultural and political setting that is supportive of user participation (Heeks 1999). The active participation and commitment of planners and developers from the central level to the local level is important in both motivating and

enabling peripheral staff and local decision-makers to participate in system design and its sustainability, thus increasing its wider legitimacy. Both local and central level users/developers/planners have roles to play either technically, financially, or operationally, and their participation is reflected in their joint efforts for design, implementation, and sustainability of the HIS. The continuous collaboration among these actors is very significant to the life of the system.

In order to address the issues of technical capacity and ownership to adapt the changing needs over time at the local level, a “participatory customization” approach (Kimaro & Titlestad, 2005) has been suggested in this thesis. This approach is different from the customization process which means that the individual user/developer changes the system design in order to reflect existing work practices and needs (Randell, 2003; Page et al. 1996). With “participatory customization”, the design of a partially developed flexible system is customized with participation of peripheral staff (with none/limited technical skills). However, they are initially trained on basic computer systems and design skills to be able to participate. Most of the work is done at the local setting with participation of the local domain experts and the peripheral staff. The developers initially work closely with the peripheral staff, to enable them to gain better practical control of the design and to understand of how their work practices and needs can be reflected in the design. The system is gradually tailored to the local context and the developer’s involvement changes from strong at the start-up stage to almost non-existent when the peripheral staff are trained and comfortable with the system. By initially being guided in design changes in collaboration with the developers in a learning-by-doing process, some users can become local experts and important local resources in the continuous process of customizing and improving the use of the system, even after the developers have left the scene. However, the participatory customization approach demands flexibility to be able to change and adapt the system to the existing and changing/increasing needs over time.

In this thesis I have provided a detailed analysis of user participation in relation to HIS development, contributing to the IS literature in several ways. Firstly, the thesis calls attention to and proposes an approach to user participation in IS development and implementation in the context of decentralization that can lead to local sustainability of the system. It describes the role of participation in the alignment of interests and responsibilities of central and local actors also at the institutional level, thereby providing learning, and enabling the sustainability of the system. This is slightly different from the main emphasis of participatory design as a way to lead to the design of an appropriate system, democratization in the workplace, and reduce resistance (or inertia) (Schuler & Namioka, 1993). Secondly, the thesis increases our understanding of the contribution of participatory design within the complex software development process given the contextual and limiting factors that exist. Thirdly, the thesis highlights the necessity of questioning notions of participation in non Western contexts. Rather than transferring traditional participatory design models, it instead suggests the importance of examining institutional, political, and technical factors that impact processes of participation, such as the initial technical capability of users, their motivation and desire to participate, political support, availability of resources, and long term support mechanisms. These factors are often

taken for granted in the West but in many cases are not present in the context of developing countries (Puri et al., 2004). Implications from practice indicates the need to start with basic computer skills training and highlights the benefits of the use of local relevant training materials and examples (e.g. use of local data in exercises) to empower and motivate the users. In these ways, this thesis builds on the literature on participation in IS design and development particularly in non Western contexts.

### 3. Decentralization and sustainability-capacity building

The decentralization and sustainability relationship is argued to be mediated by processes of capacity building. Transfer of rules and norms associated with the HIS from the central MoH to the district and sub-district levels require institutionalization process through local human capacity building. Although decentralization of the HIS has a potential to improve the sustainability of the HIS through increased control over the HIS, the potential can only be realized if local users of the HIS are sufficiently and regularly trained to support work practices, use of information, and use of computer applications to present and analyze data. I have identified four interdependent and ongoing processes of human capacity building which is presented in Figure 6.3.

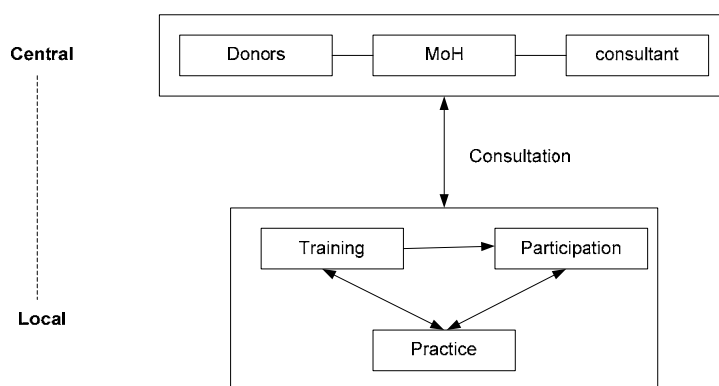


Figure 6. 3. The human capacity building as an ongoing process

Figure 6. 3 illustrates four ways of building local human resources capacity: consultancy, regular training, participation in design and implementation processes and practice (practical application of acquired skills). Fresh training of new staff and refresher training of the existing staff are required when there are changes such as such updates in data collection tools or technologies. The process of training and learning aspects of a new system may be slow and time consuming given that local users have little knowledge or experience to reflect upon (Bostrom et al., 1988). Given that they have a lack of computer use and HIS skills, the first task is to train them prior to involving them in participatory actions. During participation it is important to emphasize hands-on/practice based learning where each user uses his/her own software tools and computers as a strategy to build up their skill and confidence in using them, thereby increasing their participation. Active participation and commitment of central level officials through consultation in building local capacity is important in both motivating and enabling local learning and practice.

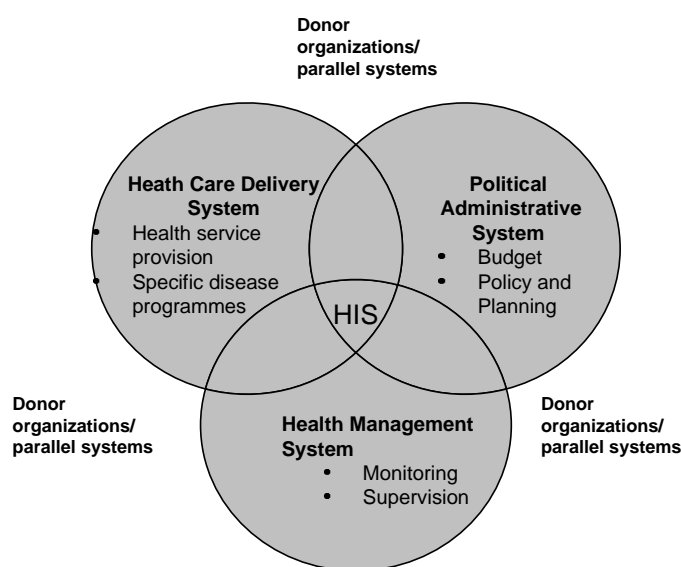
The timely transfer of resources from the central level is required to enable continuous local capacity building through regular training. Also, some of the resources required in organizing and running end user training can be minimized in the long run if such training classes are organized effectively and appropriately (Compeau et al., 1995) thereby leaving the trainees with appropriate and adequate knowledge and motivation to continue using the system (Bostrom et al. 1990). The local capacity building requires well designed and regular training associated with practices to develop appropriate motivation, skills, knowledge and experiences to sustain over time. Appropriate training is the one which leave trainees with appropriate knowledge and motivation to use the system. The motivation to use the system comes from users' practical realization of how the system can achieve both individual and organizational needs. Thus, training needs not only emphasize on the skills as an outcome but rather on both skills and motivation to use the system (Sein et al., 1998; Niederman & Webster, 1998). The skills of using computer software and applications are needed for the majority of people at the local level, whereas skills in systems management and maintenance are needed by a few people to maintain and update the system as new needs arise over time. In addition to technical capacity, the local sustainability of HISs also depends on the capacity of people at the local level to collect, analyze, use and disseminate information to understand the significance of the information they collect, and to make sense of the information and use it for action.

Thus, local human capacity building involves more than just the building of basic technical skills but also includes strategic thinking about the meaning and use of information for action. This demands a mix of skills including an understanding of the meaning of data, information and ICTs to analyze and present data in a meaningful way. However, the required 'mix of skills' is radically different between the central level and local levels. The peripheral staff have their roles in health care delivery whereas the managers and planners at the central level have responsibilities to develop health and ICT policies and often interact with donors, consultants and vendors. However, too much training on (unrelated) aspects of the new system that have no close linkage with the existing social system might hamper users' interests in using the system (Nelson et al., 1995). Consequently, training needs to be effective by being tailored to individual and organizational needs (Bostrom et al., 1988). The important thing is to establish an understanding of what trainees know, what they do not know, what they need to know, what the individual trainees and organizations needs are as outcomes of using the system and how those outcomes can be produced in the training (Nelson et al., 1995). For example, the peripheral staff needs to learn how to better manage information, use computers to process information and use that information for local planning and decision making. However, in order to build and retain appropriate human resources at the local level, there is a need to create a conducive working environment with regard to HIS use, implying better work benefits and incentives. For example, both the work procedures of the HIS need to be formalized in the regulatory and normative framework and allocated with extra financial incentives to motivate the staff involved and eliminate or minimize contradictory influences.

Studies conducted by various IS researchers have indicated a lack of awareness about ICTs and ability to use ICTs in developing countries (for example, Braa et al. 2001; Bhatnagar, 1992; Walsham et al., 1988; Sahay, 2001; Waema, 2002). I have further argued in this thesis that, in addition, to technical awareness about ICTs, extra skills are required for understanding the meaning of information and the impacts of ICTs on organizational work processes; including the bridge between ICTs and organizational activities to realize the benefits of ICTs. I have also argued that ICT related human capacity building needs to be viewed as a continuous and changing process over time and thus go beyond the development of basic skills, extending to technical and social skills, planning, interpretation of information, and management of ICTs.

#### 4. Decentralization and sustainability; influences of the organizational field

The decentralization and sustainability relationship is influenced by the organizational field, which reflects the relation between the HIS and the entities of an organizational field. Piotti et al (2006) have argued that the traditional conceptualization of organizational field (See DiMaggio & Powell, 1991a, p. 64-65; & Avgerou, 2002, p. 38) does not include the role of ICTs. These material artifacts may serve as institutional constraints (both formal and informal), and also provide the basis to create others. I have in this thesis further argued, drawing from Piotti et al.'s (2006) conceptualization, the need to broaden their conceptualization of an organizational field to also include information systems, and the formal and informal practices that surround their definition and use. A HIS is not a stand-alone system. It is formally and informally linked with a variety of entities comprising an organizational field. The design and decentralization of a HIS implies meeting the needs of these various entities of the organizational field. In the context of health care organizations, the organizational field consists of various entities (such as international agencies and the district council) comprising the political administrative, health administrative, and health delivery systems. Also influencing all of these systems are donor funded parallel systems (See Figure 6.4)



**Figure 6.4 Entities comprising the organizational field that influences the HIS (Kimaro & Sahay, 2006)**



The institutional influences originating from these systems impact sustainability of the HIS as well as the efforts to decentralize the HIS. Various informal and formal constraints relating to the HIS are intertwined with the health care delivery system, the health care administrative system, the political administrative system and donor supported parallel reporting systems. A misaligned relationship among various entities of an organizational field often leads to the unsustainability of the HIS. The weak local enforcement of formal rules around the HIS, for example the lack of penalties for delayed reports, often creates gaps between the formal rules and informal constraints. However, the lack of overlap between the formal rules and informal constraints of the HIS are caused not only by the lack of decentralization of the HIS but also by the lack of inter-linkages between the entities of the organizational field within the same level. In Tanzania, for example, the weak local enforcement of formal rules of the HIS was contributed to by existing dependence on donors and the central level, the lack of local ownership, a weak culture around data analysis and use, lack of accountability caused by heavy workload as well as lack of incentives and clear working procedures, and an ambiguous division of responsibilities. These factors contribute to violations of existing formal rules around the HIS and inhibit authority in taking appropriate disciplinary actions when work procedures of the HIS are violated. Creating these mechanisms is very complex, involving political, administrative, and fiscal processes that have independent governance systems and involve multiple administrative levels.

This thesis argues for the need to develop both vertically (across levels) and horizontally (between entities within the same level/site) alignments through participation and capacity building, in both the domains of the formal rules and informal constraints. At the level of vertical alignment, the district level is the focal point for aggregation and circulation of data across the different levels. A system like the existing Tanzanian national HIS that constantly relies on the higher levels for formal resources, but goes on according to the local informal constraints, continues to endure a lack of overlap between the formal and informal domains and a lack of legitimacy. Consequently, there is a dominance of local informal constraints due to a lack of motivation, ownership, and capacity, and a weak culture of information use and collection. The presence of these factors and the lack of adequate enforcement mechanisms or systems of incentives contributes to magnify the gap between the formal and informal domains. A focus on decentralization of the HIS is fundamental to the creation of locally relevant capacity for information use and action. Central level managers and planners need to help develop appropriate skills to manage a decentralized HIS. Also, offering incentives for performance and skill development of staff, either financial or career related, can potentially improve the sustainability of the HIS by improving the overlap between the formal rules and informal constraints. Thus, through appropriate enforcement mechanisms, work procedures, local capacity, and incentives, the gap between the formal and informal domains can be reduced or eliminated and thus contribute to a broader sustainability of the HIS.

However, the decentralized HIS is locally sustainable when it is horizontally aligned with the working systems of health management, political administrative and health care delivery since they are operationally interdependent. Horizontally arranged collaborative actions (such as meetings between

district health management team and local counselors) can help overcome some of existing limits and constraints imposed on the HIS and bring fundamental changes in the HIS. For example, local sustainability of the HIS relies heavily on the effectiveness of the local systems of health care delivery (for example registration of births, vaccines, diagnosis etc), health management (for example supervision and use of data), and political administrative (for example, through allocation of funds for incentives and resources). When the actors in an organizational field do not work as a team, there are detrimental effects on the sustainability of the HIS as a result of lack of sharing of information, learning and weak enforcement mechanisms. Thus, there is a need to harmonize the operations of entities in the organizational field (horizontally and vertically) with the HIS so as to support substantive bottom-up planning and decision making. For example, work procedures of the HIS need to be adequately aligned with similar processes of health care management, for example, the use of the information for district health planning and decision making.

In summary, I have argued the need to develop both vertical and horizontal alignments, in both the domains of the formal rules and informal constraints to ensure local sustainability of the HIS. The decentralization of the HIS is influenced by various institutional and technical factors embedded in an organizational field as indicated in figure 6.4 above. Addressing these factors involves political negotiations and participation of multiple actors, including donor funded parallel reporting systems.

### **6.1.2 Contributing to debates around “sustainability” and “decentralization” in the context of public health and IS**

The problem of failures or unsustainability of ICT based systems in developing countries has stirred up several debates. In this section, I describe the contribution of this thesis to these debates in the context of HIS.

- ***Sustainability***

The concept of sustainable development was first defined as “[...] development that meets the needs of the present without compromising the ability of future generations to meet their own needs [...]” (Brundtland, 1987). This definition has been reinterpreted in the IS field to address challenges in the design, use, and implementation of sustainable IS/IT (Reynolds & Stinson 1993; Korpela et al. 1998; Oyomo 1996; Misund & Høiberg 2003) in developing countries. Korpela et al., (1998) define sustainability as the ability to identify and manage risks threatening the long-term viability of systems. Misund & Høiberg (2003) define sustainable IT as technology that is capable of being maintained over a long span of time independent of shifts in both hardware and software. In the context of donor-funded IS/IT projects, sustainability is conceptualized as the continuation of benefits attained, if any, after major assistance from a donor organization has been completed (Young & Hampshire, 2000).

In the context of health care organizations, Braa, Monteiro & Sahay (2004) provide similar perspective on sustainability as the longevity of processes of inception, design, development, support and implementation of the system, especially once external support is withdrawn. Sustainability is thus not to be considered as the final stage of HIS development (Pluye, Potvin, & Denis, 2004), but is

concerned with all phases from the initiation of a HIS, its design and development, through to its implementation and implications once external support is withdrawn (Braa, Monteiro & Sahay, 2004).

To address local sustainability of HISs, it becomes important that the HISs become institutionalized (Manfred et al. 2001; Puska et al., 1996) i.e., they become routinized into the everyday working of the local level of health care organizations. However, I argue that not all systems that get institutionalized can be described as useful and sustainable. For various reasons, ineffective systems can also become institutionalized (Kimaro and Nhampossa, 2005). Institutionalization of the ICT based HIS in the local level of health care organization is a necessary but not sufficient condition for sustainability since there are several organizational and individual factors that can make the system become institutionalized regardless of their technical effectiveness and organizational benefits. The key concern is how systems are effective, institutionalized, and flexible. The sustainable HISs need be dependable, effective, and beneficial to the organization and its users (Akubue, 2000; Oyomno, 1996) over time. However, for such systems to continue to exist over time, they must possess flexibility to be adapted to the changing and future needs of the organization. Typically, the inflexible/rigid systems become unsustainable when they cannot be extended or updated further as new needs arise, for example when new facilities and districts are opened or closed or new treatments are offered. Also, the local level organization must have adequate capacity and resources (Lafond, 1995; Pellegrini, 1979) to translate changing needs to system design and development efforts over time.

The development of sufficient capacity for sustainability of the systems requires the participation of key users in the system design and implementation to enable them gain the knowledge necessary to sustain the HIS. Typically, the HISs cannot be sustainable independent of the key users, their social relationships, culture, and work practices (Walsham et al. 1988; Braa & Nermunkh, 2000). Also, HISs cannot be institutionalized to become sustainable unless key actors are involved and their needs and interests are addressed (Kimaro & Nhampossa, 2005). The sustainability of the HIS requires the cultivation and institutionalization of a new kind of organizational culture (Alvesson, 2002) including creating new roles, responsibilities, structures, and budgets to ensure that the HIS is integrated and becomes part of the existing routines. The existing institutionalized, ritualized routines and deep-rooted cultures within the organization can be changed through a cultivation approach. Cultivation approach (Dahlbom & Janlert, 1996; Aanestad, 2002) emphasizes that it often takes time for the new practices, rules, and meanings to be integrated and accepted in the organizations.

The cultivation approach requires an alignment of various political and technical interests of various actors through negotiations. The political negotiation is important to develop a buy-in and involvement of top management to support the system at the local level through transfer of resources and authority as well as local capacity building. While it is clearly impossible to involve everyone in the health sector in all aspects of the HIS, participation of key actors is crucial as new changes are likely to alter existing relationships, pattern of communications, and perceived influences. However, efforts to successful political negotiations in the complex environments such as the health sector in developing countries often requires effective leadership (Lippeveld, 2001) to manage coalition (team

work), consensus (agreed action), and participation (who and how to participate) and to monitor threats, rivals, and opportunities (how to deal with existing vertical programs) on an ongoing basis.

The actions of health workers in the HIS are enabled and constrained by the social structures within the health care service organizational structure within which the HIS is situated (Walsham & Han, 1991; Walsham, 1993). People act within structures that they change through their actions, which gives them the ability to change their environment (Bratteteig & Gregory, 1999). The change within the existing HIS can occur when existing structures are modified in the course of actions and interactions of people. The changes occur as people reflect upon their actions, that of others and both their intended and unintended consequences. When people view the consequences of their action as negative, then they are likely to take different action in the future with different but related changed structures thus cultivating new structures and new actions. However, this requires human capacity to evaluate their actions in a reflective manner by learning the consequences of their actions (Giddens, 1984; Walsham, 2002) and to plan for changed action for better outcomes.

The local sustainability of HIS is highly dependent on the institutionalization and cultivation of a new kind of culture to enable health workers to record and compile high quality data and managers to use that information for local action. However, cultivation and institutionalization of a new culture requires the presence of sufficient capacity, resources, and a conducive working and administrative environment. For example, the development of attitudes towards timely data reporting and use of information requires motivated and skilful workers, incentives, appropriate working procedures, and availability of timely resources.

- ***Decentralization of HIS***

The IS debates (in commercial companies) around decentralization and centralization of systems have focused on technical and economic advantages and disadvantages of the decentralization against centralization of the technical system (King, 1983; Rockart & Leventer, 1976). In public sector (not for profit organizations), decentralization of IS is linked to non-technical and non-economic factors such as political, administrative and institutional. Generally, there is limited critical and analytical literature discussing the institutional, technical organizational and political factors of decentralization of IS generally and HIS in particular. In the context of decentralized organizations like in the health care sector, Walsham (1992) proposes a “bottom-up” IS decentralization and change process, without explicitly detailing how that can be done. Braa & Hedberg (2002) adopted a “bottom up” change process in the decentralization of HIS in South Africa, a process which significantly facilitated by the socio-political and historical conditions related to post-Apartheid.

The decentralization of HIS involves social, institutional, technical, and political changes whereby various institutional influences and different possibly competing logics need to be negotiated and aligned in a participatory way. Walsham (1993) has argued that much of IS research has focused on processes of change, with little emphasis on its link with the intra-organizational and broader context. The introduction of any technical system involves also significant changes in social

procedures, roles, social interactions, including various facets of the institutional context. HIS are constrained by the institutional context in which they operate and, also have the potential to change them. According to Walsham (1993), organizational change is not a straightforward, rational process but rather is a complex, political, and historically situated. He further argues that changing of shared and entrenched beliefs requires a long term political learning process, influenced by motivated and skilled leaders (Walsham, 1993).

Although organizations are affected by their institutional environments, they are also capable of responding to these influences both creatively and strategically (Scott, 1995), largely shaped by capable and knowledgeable human agency (Walsham 1993). Changes are shaped by a situated rationality, which Simon (1982, p.408) describes as representing “a style of human behavior that is appropriate to the achievement of given goals, within the limits imposed by given conditions and constraints”. An organization can confront both output and procedural demands, forcing it to act rationally to respond to them, for example, by developing special units, or task forces with formal aims (Scott, 1995). However, the dominance of the informal over formal constraints implies that formally planned changes would take time to be understood, accepted, and routinely applied. Thus, changes need to be institutionalized incrementally through cultivation by making them be part of the routine organizational activities. Change needs to be viewed as an on-going process of anticipated, emergent and opportunity based events (Orlikowski & Hofman, 1997). These three forms of change often co-exist over time and are linked to both intra-organizational and broader social contexts (Orlikowski & Hofman, 1997). Decentralization of HIS is to be considered as an opportunity to improve health care delivery, requiring managed changes in human capacity building, creation of local HIS management and working functions, and allocation of resources for HIS management (Lippeveld, 2001; Williamson et al. 2001). Thus, decentralization of HIS involves creating roles, practices, meanings, authority, incentives, and budgets for HIS and their institutionalization at the local level.

Decentralization requires appropriate policies and regulatory frameworks, as well as actually redistributing both authority and financial resources of the HIS from the central to the local level. For example, the authority to control fragmentation of data reporting through donor funded parallel systems, enforce formal rules, facilitates local capacity building, and use of information for local action. The main consequence of donor systems is the increased work burden to health care workers at the understaffed health facilities (Chilundo & Aanestad, 2003; Monteiro, 2003) which tends to divert their focus on the national HIS. The bottom up changes often require top-down participation and commitment of central level officials and donors to facilitate local capacity building, creation of local motivation and ownership.

Decentralization of HIS involves the institutionalization of HIS into local routines of the health care delivery system, and the health management system and political administrative system to make it locally sustainable. HIS is locally institutionalized when its routines are regarded by health workers and health managers as the ‘appropriate’ or ‘natural’ way of provision of health services and management. As new ideas, interpretation, work practices of the HIS are institutionalized, they tend

to replace the existing informal constraints and, over time, they become taken for granted as ‘how things are’ and ‘the ways these things are done’ (Scott et al. 2000). The decentralization of HIS is associated with various local challenges. The fact that most health facilities are understaffed and inadequately financed, can make it difficult to improve data handling practices, organize training, and the use of information. New ideas, meanings, and practices that are introduced through training may not be as effective towards changing work practices as quickly as expected since direct health service provision and administrative duties can take precedence over data handling practices (Mosse & Sahay, 2003). However, emphasis on continuous training, practice, administrative commitment and political brokering, can ultimately lead to improving the practices of HIS. Thus, the changes in HIS in the local context may be hard when considering problems related to organizational, political, and institutional complexities. However, overtime, benefits can be generated, specifically related to a reduction of excessive work demands that arise from donor funded parallel systems.

The local institutionalization and cultivation of HIS occurs incrementally as organizations create new work practices, or district units, hire new staff, for dealing with HIS. However, creation of these new structures for HIS requires interests from the central level, local capacity, and political pressures of key actors such as donors, central and local health officers. In the contexts of developing countries, which are highly dependent on donor support, the rapid changes are obviously difficult given costs involved in the creation of new roles, capacity building, hiring new staff, and the provision of regular local support and maintenance. However, when the existing institutionalized structures and beliefs are changed, the future change processes can continue rapidly (Scott et al., 2000).

## **6.2 Practical contributions**

Four practical implications are identified to arise from this study. These are firstly summarized in Table 6.1 and then further elaborated on.

<b>1. Need to address the lack of overlap between local informal constraints and imposed formal rules which in turn makes the HIS locally unsustainable</b>
<b>2. Consider the various disparate influences arising from the multiple entities that comprise the organizational field to support decentralization and sustainability of HIS</b>
<b>3. Create a wider legitimacy of existing HIS through participation and political negotiations between various stakeholders</b>
<b>4. Align the various decentralization processes related to health delivery systems and HIS</b>

Table 6.1 Practical contributions

### **6.2.1 Need to address the lack of overlap between imposed formal rules and local informal constraints**

The implementation of the HIS at the local level usually does not acknowledge the presence of local informal constraints. The imposed formal rules are not interpreted and understood similarly by

individuals at the local levels (Piotti et al, 2006) and central level HIS officials. The findings of this thesis reinforced the argument that when rules are imposed by higher levels with little understanding and acceptance of the peripheral staff, it subsequently leads to only partial compliance. The findings have implications for the daily actions of managers and health workers in the lower levels of health care organizations. Health workers and health managers who are supposed to utilize the data they collect, tend to perceive HIS tasks as secondary to the provision of direct health services. The health workers fails to report data on a timely basis due to their realization that data they collect are not beneficial to themselves and not effectively utilized at higher levels since they often do not receive any feedback. The existing formal rule for enforcement is supervision, mechanisms which tend to remain neglected in practice. Supervision and feedback are often conceived as a reprimand exercise rather than for providing guidance and learning as well as for creating mutual understanding on the use of data for local action. Consequently, there is a dominance of informal constraints such as lack of motivation, ownership, and skills, and a weak culture of information use and collection at the lower levels, negatively affecting the local sustainability of HIS.

The weak local enforcement of formal rules associated with the HIS (such as lack of supportive supervision, and data validation) is contributed to by the centralized nature of the HIS that creates increased central level dependences, lack of ownership, and incentives and a weak culture around data collection, analysis and use. The low incentives to perform and monitor data quality at the health facilities is contributed by the limited utilization of collected information for local action. Offering incentives for performance and skill development of staff, either financial or career related, can potentially improve the functioning of the HIS through increasing the overlap between the formal rules and informal constraints. Also there is a fundamental need to allow participation of peripheral staff in the design of their own system to create sufficient local ownership and capacity.

### **6.2.2 Consider the various disparate influences arising from the multiple entities and their inter-linkages that comprise the organizational field**

This thesis has described the notion of an organizational field as comprising of various systems that influence the local sustainability of the HIS. The health care delivery system is mandated to provide health services to the populations; the health management system manages and administers the provision of the health services; the political administrative system formulates and enforces rules and norms governing health services delivery and allocates resources, and a system of donor support through a multiplicity of international aid organizations provides support to different vertical health programs.

Apart from the material exchanges amongst these entities of the organizational field, such as informational reports, plans, or financial disbursements and drug supplies, they also exert other normative and/or cognitive influences. These influences are exercised at the same level of the health structure (e.g. district) or between levels (e.g. districts and regions for example), shaping activities such as the development of health plans, reporting of data, or the conduct of supervision. Inherent

contradictions that exist in these activities and structures contribute to create a lack of overlap between the formal rules of HIS and existing informal constraints which make the HIS unsustainable.

The district council is responsible for the implementation of health policies, monitoring the use of funds as well as administering the provision of health services and human resources at the district level. This entity shapes the performance of the HIS in many ways; for example, through insufficient and untimely disbursement of funds which constrains activities such as supervision of health services, reporting and collection of routine information. Simultaneously, the HIS routines of supervision and reporting depends on personnel knowledge or formalized patterns and cooperation (use of information in decision making) of the district health management and health facilities authorities. International donor organizations, through their financial strength, influence all these entities within the same level or from higher levels. Thus, the systems of health management, political administrative and health management in conjunction, significantly influence the local sustainability of the HIS.

Thus, for the HISs reforms to be sustainable, they need to be compatible with similar processes of the entities of an organizational field. The overlap and linkages between formal and informal constraints which shape the above systems can help to develop better work routines, enforcement mechanisms, incentives, resources, capability and capacity for the HIS. The effective enforcement mechanisms created horizontally (e.g. use of information in decision making, supervision of District Medical Officer (DMO) to HMIS management, follow up meetings) can contribute to reduce the existing gap between the formal rules and informal constraints to bring fundamental changes in the HIS and its sustainability.

### **6.2.3 Create a wider legitimacy of the national HIS through participation and political negotiations between various stakeholders**

In the context of Tanzania, due to the current top down technical focus and the limited existence of incentives and specific resources for HIS at the lower level, HIS has limited legitimacy for the staff. The developments of the existing national HIS (called HMIS) in Tanzania was based on the analysis of requirements of planners and managers at the central MoH. There was little consideration of the needs and requirements of various vertical programs and providers and managers of health services at the PHC sector (Mwangu, 2003). The formal rules of the HIS such as definitions of data elements, indicators, and design of data collection tools were designed at the central level and changes also controlled by them. Centralization of HIS activities has contributed to a lack of legitimacy of the HIS at the district and health facilities due to imposed rules divorced from specific local realities and imposed through an autocratic style of management. Consequently, health workers tend to collect data just to respond to the needs of higher authorities without putting much emphasis on quality data.

The existing HIS lacks flexibility to accommodate emerging needs from existing vertical programs. The local level lacks systematic support from the central level such as regular training and maintenance. The HIS design limitations means that the system is ineffective in terms of generating the information needed for action. Although, the health management was in theory decentralized, the



performance of the HIS was poor in terms of reporting data quality and supervision. As a result, information obtained from the HIS is rarely used at the local level (Mwangu, 2003) except for sending it upwards, reflecting the needs of the higher level bureaucracy rather than to support local actions (Sandiford et al., 1992). Health facilities were grossly understaffed and overloaded with clinical activities at the expense of the HIS. The poor performance of the HIS lacked visibility within the spheres of political administrative and health administrative systems, reflected for example in the inadequate emphasis on training and supervision.

This thesis highlights the fact that HIS currently has low legitimacy amongst the various actors at multiple levels. Legitimacy implies gaining local administrative and political support of HIS. The norms, rules, meanings associated with the HIS were not fully institutionalized to obtain the required legitimacy. Consequently, most vertical programs managers do not trust the national HIS since they were not consulted in the design process, making the national HIS further lose its wider legitimacy. Legitimacy can be encouraged through participation of key actors in the design of the decentralized HIS and through a fuller institutionalization of HIS into the various entities of an organizational field, both of these mechanisms have been largely absent in the Tanzanian case. The institutionalization of HIS must be carried out such that it leads to its wider legitimacy requiring associated rules to be adapted incrementally through cultivation.

#### **6.2.4 Align the various decentralization processes related to health delivery systems and HIS**

Despite the original intention of the Tanzanian national HIS to support decentralization and facilitate local ownership and use of data (Rubona, 2001), these visions have not been realized in practice. Efforts to implement the HIS have not been adequately aligned with similar processes of the PHC delivery system. For example, the intention was to stimulate use of the HIS information for district health planning and decision making (Mwangu, 2003) in order to improve PHC services. However, the weak linkage (e.g. lack of cooperation, use of information, and resource flow) between the health delivery system (PHC) and the HIS in practice contributes to a lack of motivation for quality data recording and reporting from the health facilities.

The local health delivery system has direct influence on the sustainability of HIS through data collection, compilation, reporting and use of information for action. Although the HIS operates within and supported by health delivery system, in practice, the planners and implementers of reform efforts treat the HIS and health delivery system as two sets of independent systems, leading to locally unsustainable HIS. In Tanzania, for example, the introduction of HIS at the local level significantly ignored the alignment of the work procedures of the HIS with those of the primary health care delivery system. Consequently, the existing HIS has not been fully institutionalized to become part of the work routines of the health care delivery system. Health workers regard the HISs as a constraint to their work of provision of health services. Given such lack of local ownership, the HIS is often plagued

with poor quality data, undermining the provision of preventive care and informed decision making and planning.

The local sustainability of HIS depends on its gradual integration into the health care delivery system with the HIS regarded as a part of health service provision. Thus work practices, meanings, norms, and rules embedded with the HIS need to be harmonized with those of the health care delivery system. Typically, the health care delivery system consists of their own rules, norms, and work which are often in tension with imposed formal rules of the HIS. The HIS can be made part of the health delivery system, for example, through the formal appointment and job descriptions of appropriate levels of staff responsible for aspects of HIS and establishment of their career incentives. Also, HIS authority needs to be sensitive to all counterproductive processes and existing misinterpretation about HIS and information in the health facilities. This involves taking steps to empower health workers with appropriate skills (by building new understandings and perceptions towards information interpretation and use), providing supportive supervision as well as creation of a conducive environment (with effective procedures related to the collection, reporting and use of information) where information is a valued and reliable foundation for local planning and decision making (Mukama, Kimaro & Gregory, 2005).

However, the HIS cannot become part of the health delivery system without participation (in the design of HIS) of those in-charge of health facilities and health workers who are supposed to use and sustain it. The lack of participation of these individuals' affects the process of institutionalizing and use of the HIS, positioning it as an imposed system from the health management levels above. Thus, the ongoing efforts of decentralization of HISs in developing countries need to be aligned with the health delivery systems to make the HISs locally sustainable. The need to strengthen the HIS along with the health care delivery management has recently been emphasized by the World Health Report (2004). The HIS needs to be designed within the PHC delivery framework to help make visible existing health status of the communities to improve local management of health services and to help to develop appropriate policies at higher levels.

## CHAPTER 7

### CONCLUSIONS

This thesis has presented an in-depth empirical study of the inter-linkages between processes of decentralization of health systems and the associated HISs, and local sustainability of HISs. Using concepts drawn from information infrastructure perspective and institutional theory, I have developed a theoretically informed empirical understanding of the relationship between the decentralization and sustainability of the HIS in the context of developing countries. Decentralization of HIS is required to: 1) better support the provision and management of health delivery services, 2) to strengthen the local management and technical capacity to utilize the routine information for local action, and; 3) to have the capacity to be able to evolve the HIS with the changing needs.

Decentralization involves both a political, institutional, and technical change process, for example, through creating political visibility of information to help argue for making advocacy for more sufficient resources. Decentralized authority is needed for various purposes including managing information and ICTs, conducting regular training, and for closer supervision. Thus, decentralization of HIS is viewed as an institutionalization and cultivation process that can ensure the system is embedded in the local setting and acquires required legitimacy, and that there are sufficient resources to sustain it over time. Unfortunately, many attempts by governments and donor organizations concerning the design, development and implementation of locally based HISs in various developing countries including Tanzania have resulted into limited results and HISs remain largely fragmented and locally unsustainable. Consequently, the HIS is plagued by poor quality of data, lack of appropriate local capacity, absence of formal roles, responsibilities, and resources for the HIS as well as limited use of information for local action. The lack of effective and locally sustainable HIS is generally viewed as a major obstacle for efficient management of the health services and the health sector in developing countries.

Decentralization requires that multiple existing institutional influences and contradictions be aligned. A top down decentralization strategy often leads to widening the gap between imposed formal rules and local informal constraints as top senior managers often tend to ignore existing local informal constraints. The different entities of an organizational field operate within their formal rules and informal constraints, and often biased towards their own formal rules and authority. The actors in the health delivery system accordingly obey formal rules that are radically different from formal rules that prevail at the administrative level, for example giving more priority to providing care to patients than producing routine statistical reports. Health workers feel less motivated and overloaded or that their extra roles require extra incentives. The health workers and health managers operate within different institutional systems which provide different influences on HIS. The formal rules and informal constraints of health delivery and management systems are not necessarily supported by formal rules comprising a system of vertical health programs.

Consequently, the decentralization process needs to create linkages between different entities of an organization field. For example, strengthening cooperation between district health management team and political administration can create the political legitimacy to ensure the availability of timely and sufficient resources for creating local sustainability of the HIS. The supportive cooperation between the health delivery system and HIS authority can create a health delivery system that is supportive of quality data needed for the management of the health services. Both horizontal and vertical linkages can be created through the participatory processes, which seek to design the system to fit interests of its users and authority. Through participation, the existing overlaps, contradictory influences, and opportunities can be assessed and negotiated between the key actors comprising the organizational field. However, employing the participatory approach may not be a straight forward process given the existing autocratic style of management, weak technical capability, and presence of dominant local informal constraints. The participatory process needs to be accompanied by training programs to develop learning and sufficient local human capacity to engage in participation.

Effective decentralization of a HIS requires the creation of a wider legitimacy through participation. The design and operation of the HIS must align with the information needs and interests of the various entities of an organizational field. Also, the creation of information use culture within the various entities of the organizational field is necessary to ensure that information generated from the HIS is used as basis for their better decision making. Demonstrating the benefit of information use over time can encourage different actors to support the HIS and can contribute to create an information use culture. At the local level, there is weak human capacity around the HIS. For this reason, extra resources and regular trainings are required to build skills and commitment of the peripheral staff to support the HIS through generation of quality data and to change existing ideas and ways of thinking about the use of information. The human resource capacity required is more than just technical basic skills and includes strategic thinking about the meaning and use of information for action. The local sustainability of the HIS depends significantly on the locally available human capacity to collect, analyze, validate, use and disseminate information and using it for action. The training programs (on/off-site) can be used to build different skills and knowledge ranging from managerial, planning, information management and use to ICT skills. However, the human resources required at the local level cannot simply be resolved through increased training programs only. It also requires hiring of new skilled staff to support and manage health services and the HIS.

The application of traditional systems development models for the HIS development may not result in a locally sustainable HIS. It requires alternative and combined approaches that can lead to the creation of appropriate local ownership, capacity, flexible system, and a new organizational culture. In this thesis, a cultivation and institutionalization approach is suggested as an alternative strategy for decentralization and sustainability of the HIS as it can lead to accumulation of resources, local shaping of new cultures, and human capacity building over time. The cultivation and institutionalization approach also needs to involve institutional changes through learning and training programs to create

new meanings, techniques, and work procedures around data processing and use while gradually de-emphasizing informal constraints that are incompatible with formal rules of the HIS.

Typically, what is transferred from the central to the local level is an inflexible HIS, with the local people acting as a conduit of information transmission and working based on guidance and resources from the central level officials. They, however, work without appropriate skills, timely resources, motivation, ownership and incentives to sustain the HIS locally. The flexible HIS is required to allow for continuous changes to meet the required needs of the various entities of an organizational field over time. The flexibility required involves flexible software, tools for data collection, analysis and reporting as well as work practices and planning. The flexibility of software is related to the potential to add, modify, or delete data elements, indicators, functionality and operations. Thus, software application needs to be open source and easily customizable to allow new emerging needs to be incorporated over time. It also requires effective local human capacity and leadership to help to manage the cultivation and institutionalization process. Thus, decentralization of the HIS must be accompanied by policies to create appropriate local financial and human resources and information use practices.

The theoretical framework developed in this thesis proposes a conceptual linkage between the decentralization and sustainability. The relationship between decentralization and sustainability is seen as embedded in various kinds of infrastructures and institutions comprising what may be called an organizational field. It emphasizes institutionalization and cultivation of the effective and flexible HIS through participation, learning and training, and aligning of interests. Decentralization of the HIS needs to involve transfer of resources, responsibilities, and decision making of the HIS from the central to the local district levels. Decentralization process must be aimed to create required local capacity, ownership, and resources to make the HIS locally sustainable, in contrast to the transfer of responsibilities without the necessary authority to make the changes possible.

The theoretical insights and empirical findings of this thesis are not unique to HISs but also have relevance for other kinds of ISs and ICT development projects in different contexts. Generally the thesis emphasizes the need to acknowledge “the force of both the formal and informal institutions” and adapt strategies to deal with this.

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## **APPENDIX 8**

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## **APPENDIX 9**

**Questionnaire used for assessing design, development and support of computer existing based HIS in Tanzania**

<b>Questionnaire Prepared and Used by Nhampossa and Kimaro (2004 &amp; 2005)</b>			
<b>Health information system development</b>			
<u>Date and time:</u>			Place:
Position:			
#	Question		
1	What was the purpose of the project?		
2	What were the expected outcomes		
3	Who were the target end-users		
4	Who were involved in defining the purpose of the project? Donors? Consultants? Managers?		
1	How end users were involved?		
2	What role did you play in this process?		
3	How was the decision on functionality, user interface design and development platform taken?		
4	Who were involved in the design process and what were their roles?		
5	How long was the design process?		
1	What kind of development approach was followed and who proposed it?		
2	What were the criteria for selecting the developer?		
3	Who were involved in the development process and what were their roles?		
4	How long was the development?		
5	What was the mode of payment? Deliverable dependent, by installments or completion-dependent?		
6	Was the system evaluated or tested?		
7	If yes how? Before or after delivery and by whom?		
1	How was the appropriateness of the system tested before implementation and who tested?		
2	To whom the system was delivered, when and how?		
3	Who were involved in the implementation process and what were their roles?		
4	What was the rolling out strategy?		
5	How long was the implementation process?		
1	Was any training conducted before the implementation?		
2	Who were involved in the training process and what were their roles?		
3	How the top managers were trained?		
4	How many training cycles were conducted after implementation?		
5	What were the criteria for selecting of trainees?		
6	What was the purpose of training?		
7	What was the background or position of the trainees?		
8	How many trainees or trainers per unit were involved?		
9	Where the training was conducted and how was it organized?		
10	Do you need more training?		
1	Does the system satisfy the needs of the MoH? (or of your work)		
2	How effective is the data handling process?		
3	Is the system output reliable for making decision?		
4	Is the system easy to install, understand and use?		
5	Is there any documentation or user manual available?		
6	Is the system free of bugs or errors? If yes what kind of bugs are generated?		
7	How often do you use the system and for what purpose?		
8	What factors contribute negatively to the use of the system?		
1	Is there any user support?		
2	Who provides support? MoH or developer?		
3	Who provides technical support? E.g. Hardware or software?		
4	The support is on request or regular basis?		

5	How often the support is provided?		
6	What kind of support is provided to the users?		
7	How is this communication facilitated among top managers, lower-level users, developers and donors?		
8	Have you ever received feedback? How long did it take?		
9	What kind of feedback did you receive?		
10	What kind of problems you often face when using the system?		
11	To whom you report the problems?		
1	What were the sources of funding for design, coding, testing, implementation, and training?		
2	What was the role of the local government in funding the HIS?		
3	How long was the donor funding for design, coding, testing, implementation, and training?		
4	What were the sources of funds for maintenance and further development?		
5	How the donor funds were monitored or coordinated?		
6	How was the funds given to the MoH? As a full package or by installment?		
1	There is any plan to improve the system?		
2	If yes what is the plan?		
3	How the plan is going to be accomplished?		
4	What factors are likely to affect the plan and how do you intend to address them?		

**APPENDIX 10**

**Questionnaire used for assessing decentralization of Health System/HIS in Tanzania**

Category	Questions
<b>A.</b> ADMINISTRATIVE POWER	<ol style="list-style-type: none"> <li data-bbox="499 259 1388 524">1. What processes of decentralization of health system are going on at the district level and when started? What are major problems encountered in implementing strategies of decentralization of health services? Do the people understand decentralization issues? How? Any training going on? Is there any written guideline on decentralization? Suggest kind of training required? What are the advantages and disadvantages of decentralization realized so far in terms of efficiency, equity or effectiveness?</li> <li data-bbox="499 524 1388 622">2. What are the managerial/planning skills, decision making process and organization structures do exist at the district and regional levels (before and after decentralization)?</li> <li data-bbox="499 622 1388 763">3. What capacity building activities have been conducted over past 5 years to strengthen the HMIS at districts and health facilities? What kind of human capacity exists? For example the one who deals with information management-collection, analysis and presentation</li> <li data-bbox="499 763 1388 931">4. How is the interaction and relation among Community, CHMT, DMO, CHSB, and FC like? What administrative barriers and power collisions exist and how they happen or solved? Give some examples. Do CHMT and HMIS coordinator cooperate for data management at the district level? How?</li> <li data-bbox="499 931 1388 1093">5. What process it take at the district level to hire, fire or discipline an employee? (Give procedures, people, meetings, authorities involved). For example a HF in-charge who has not prepared his quarterly report.</li> </ol>
<b>B.</b> DECISION MAKING	<ol style="list-style-type: none"> <li data-bbox="499 1106 1388 1267">1. What has been decentralized and what remain centralized? What kind of decisions still comes from above (e.g. MoH, PORALG) to the district level (budget, allocation of resources) and how? What efforts are currently underway to decentralize power and resources to district or regional levels and when started?</li> <li data-bbox="499 1267 1388 1408">2. What resources or power the district or regions lack in allocating resources or making decisions (before and after decentralization) or what tasks must be approved by higher levels (e.g. budget, use of funds, employment, changes in HMIS).</li> <li data-bbox="499 1408 1388 1644">3. What kind of information (data elements) do managers need for making decisions and planning? What are the sources of that information at your level? Do you really need information from HMIS for decision making in its current status? What efforts are underway to obtain reliable data through HMIS? Is the information required and analysis within different levels clearly defined? If not what is the cause?</li> <li data-bbox="499 1644 1388 1742">4. What is the procedure through which planning is made, who are involved and how and when? And how higher levels (e.g. MoH, RMO, PMRALG) help or constrain the process?</li> <li data-bbox="499 1742 1388 1910">5. Did the decentralization change the information needs or HMIS procedures at the district or regional levels? What is the new information needs after decentralization process at the district level? How the new information needs are addressed in HMIS and how higher levels were involved in the process?</li> <li data-bbox="499 1910 1388 2016">6. How do you interact with or manage vertical programmes and how new contracts are made with external sources of funds such as donors. What are the existing tensions between vertical programme and</li> </ol>

	<p>HMIS routines? Is there any policy/strategy/plan/effort that supports integration of data/information from different programmes/sources?</p> <p>7. What sources of funds or means of fund generation do you have? How do you obtain that funds and what steps and times it take? (Explain any bureaucracy that exists). Is there a specific national government budget for core funding of HMIS activities? If yes, how much is it out of the total budget of the district/region and for what activities does the budget is allocated? Is the budget controlled centrally by the MoH or PMRALG? How?</p>
<p><b>C.</b> COMPUTERS (AND ACCESSORIES) AND SOFTWARE</p>	<p>1. How many and kind of computers and software do you have at your level, when and how you obtained them and how they were introduced? Was the decentralization process a motive behind their introduction? How? What kind of human resources exist for their use and maintenance? How computers and software acquired used for information processing and analysis? What kind of tasks computers needed most in your working place? Is there any increase in work efficiency? How? What is the different from the time when there was no computers/software at your place and now?</p>
	<p>2. Can CHMT or health managers utilize computers and software? What kind of software? For what purpose they use? How do they deal with computer faults? What are procedures for acquisition of computers and hardware accessories such as hard disk, printer, toner and data storage devices? Do you have any budget for computer hardware and software? How funds are obtained? And how much and how often a year? Do you have to get any approval from the higher levels to buy computers? What kind of approval and how long it takes?</p>
	<p>3. What is depended to the higher levels regarding use and acquisition of computers and software? (e.g. technical support, acquisition of hardware etc)</p>
	<p>4. What kind of computer training often provided to employees? How is it provided and by whom? What was the source of funding? What are the available skills and needed skills? Who is responsible to arrange for training (Individual or organizational motive) and what steps it take?</p>
	<p>5. Do you think the use of the DHIS is important at your working place? What can be done to make the DHIS use more effective and fully accepted at the district, regional and national levels? What procedures must be followed to make it a national system operating at all levels or entire health sector? Who must approve the process and where to start? (District, Region, MoH, PMRALG, FC?)</p>
	<p>6. Do you use the information generated from DHIS to support decision making at the districts? If not what is the barrier and what is to be done? Do you require any higher level approval to use such information? What kind of sanction you require from above? Or what changes need to be done on the DHIS to make it more users friendly?</p>
<p><b>D.</b> HMIS</p>	<p>1. When and how the paper based HMIS was designed and what was the role of district, region, health facilities or donors? How were CHMTs/managers at your levels involved in design of indicators, data elements, reports and information flow of HMIS? How were the district needs incorporated and what are the information gaps?</p>
	<p>2. How the process of HMIS design or its implementation linked with the decentralization of health system. Is there any relationship between the on going decentralization of health system and operation of HMIS? Give example of such linkages</p>

	<p>3. Given lower levels' administrative, financial and political power, why problems such as lack of supervision and verification of data, untimely reporting, and poor reporting continue to persist? What kind of resources required from higher levels to solve these problems? What must be done at the lower levels apart from delivering training? What can be done to ease the job of data handling? What are the future plans (if any) to strengthen HMIS activities at all levels, more specifically to establish strong HMIS units at district levels? Is the issue of an improved HMIS on the political agenda of key policy makers politicians at district, regional, and national levels? (assess decentralized power to the local levels)</p>
	<p>4. Can HMIS fully support planning and decision making at the district and regional levels? If not what must be changed or done and how? What efforts are underway at your working place to impose or suggest those changes? What is the major identified obstacle (s)? Do you suggest re-design of HMIS to reflect the decentralized health system at the district level? Why, how and who must be involved?</p>