In Search of the Missing Data

The case of maternal and child health data in Malawi

by

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Acronyms

CHAM	Christian Health Association of Malawi
CoP	Community of Practice
DHMT	District Health Management Team
DHO	District Health Office
EHP	Essential Health Package
HIS	Health Information System
HMIS	Health Management Information System
HMN	Health Matrix Network
HSA	Health Surveillance Assistant
ICT	Information and Communication Technology
IS	Information System
MCH	Maternal and Child Health
MDG	Millennium Development Goals
MMR	Maternal Mortality Ratio
MoH	Ministry of Health
NGO	Non-Governmental Organization
NSO	National Statistics Office
SBA	Skilled Birth Attendant
SRHR	Sexual and Reproductive Health Rights
SWAp	Sector Wide Approach
T/A	Traditional Authority
TBA	Traditional Birth Attendant
WHO	World Health Organization

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To my mum, Evelyn

for

the love, encouragement and patience

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Abstract

Health reform initiatives in most developing countries include introduction of information and communication technologies (ICTs). Conventionally, it is thought that the introduction of ICTs will also help to modernize traditional work practices around data is collection, processing and reporting. However, this is not necessarily the case in a setting where there is a duality of modern and traditional practices. The traditional practices are deeply embedded in the cultural, economic and social life of people, something which ‘computerization’ fails to overcome. The dilemma is that although a high percentage of pregnant women still utilise the traditional health sector for delivery and child care, most of this data is not collected and entered in the official health information systems (HIS). In Malawi, as in most sub-Saharan Africa in general, the majority of people (about 80%) reside in rural areas, with limited abilities to access or afford the modern health services, forcing them to rely on traditional health services. Despite this demographic reality, most reform initiatives involving ICTs tend to focus on the health facilities (“modern” health sector) and not on the rural community (traditional health sector) which is majority of the population.

In this thesis, I explore the challenges in realizing good data quality for HIS in this context. Socio-cultural conditions, governance issues, various policies, and political realities, are all seen to (adversely) influence the quality of data, and this thesis explores the nature of these influences. The research also addresses whether the current HIS implementation, one that excludes those using traditional services, can provide solutions to strengthening HIS data quality and support health improvement interventions. Empirically, I use case studies from Malawi, focusing on maternal and child-health-related data. An interpretive approach using qualitative methods was adopted in the study in order to uncover the depth and breadth of the practices that leads to generation of maternal and child health data in both modern and traditional health sectors. Data was collected over a two-year period from June 2008 to July 2010. Theoretically, concepts from the community of practice (CoP) theory are used to establish an understanding of practices across the traditional and modern sectors of the Malawi health system, the flow of data, and nature of links within these networks.

The thesis draws contributions to the information systems field, specifically HIS, and to the health domain. Theoretically, the study extends the CoP theory with *weak link* concept. Practices, knowledge, and data are shared across the organization through CoPs linkages, and these links needs to be strengthened. If any of the links is weak, knowledge, practices, and data are not shared consistently and some data may be lost. Practical contributions include the following recommendations: i) From a political perspective, the formulation and implementation of policy decisions should be guided by consensual processes, involving participants from health sector at all levels, and not rely on the use of top-down approaches. ii) governance mechanisms needs to utilize existing structures and enhance existing practices to capture data - such as having a village chief record the data when community members reports a birth and/or death in their community. iii) There is need to introduce policies that enhance strong collaboration between modern and traditional health sectors, allowing births taking place out of modern health sector to be recorded in a health passport by a chief. iv) Knowledge and practices generated in the traditional sector need to be taken on board to assist in capturing data generated in that sector. Community health workers known as health surveillance assistants (HSAs) should act as knowledge brokers, and should be given hardbound note books for capturing data instead of loose forms. In areas where there is coverage, HSAs and chiefs should be given mobile phones for sharing data.

1 Chapter One: Introduction

This chapter gives an overview of the research questions addressed in this thesis. The chapter is divided into four main sections. The first section gives description of the problem area, my motivation for embarking on this research, and significance of the study. The next section describes the research aim and questions. This is followed by theoretical perspective used to guide this study, a brief description of the empirical approach, and research contributions. The chapter concludes with the thesis organisation.

1.1 Research Problem Area, Motivation and Significance

The health sector in Malawi, as is the case in most developing countries, comprises of two sectors: "modern" and "traditional". The modern health sector provides services to treat patients with curative, preventive, and palliative care, and depends on interdisciplinary teams of professionally trained, paid personnel (WHO 2011) who use modern/western medicine and practices (Stieg 2011; WHO 2011). The traditional health sector, on the other hand, refers to norms of wellness, and health services that tend to be locally derived and based on community focused practices (Juliá and Kondrat 2005) that rely on theories, beliefs and experiences used to maintain health in different cultures (WHO 2011). Further, there is tremendous diversity within the traditional health sector in developing countries (Hewson 1998; WHO 2003; Mills, Cooper et al. 2005) including different types of traditional healers, traditional births attendants (TBAs), spiritualists and village leaders.

Traditional providers have an important role in health-care delivery, particularly in rural areas where modern medical care is limited (Mills, Cooper et al. 2005). The most common traditional providers in Malawi are TBAs and traditional healers. TBAs are an important foundation in deliveries and child births in Malawi (Fortney and Smith 1999 ; UNICEF 2009; Nove 2011). The traditonal health providers do not involve professionally trained nurses or physicians, they are self-taught or informally trained, their knowledge is often passed on orally over generations. This involves a sophisticated system of knowing with well entrenched practices (Zhang 2000; Hills, Finch et al. 2006). Both modern and traditional health sectors provide primary health care services to the population, and the degrees of services vary with various factors including local cultures and access to care.

The two sector classification of the health sector has been largely based on the nature of services provided and also who can access what. Classification is seen as a way of promoting analytical clarity and gives advantages –[or in some cases disadvantages] (Bowker and Star 1999). Just like Bowker and Star locate the emergence of changing systems and forms of communication from human speech to telephone and internet technologies, there are also cases in the health sector where data emerging from communities changes from oral in the traditional health sector to paper-based and electronic forms (also ranging from stand-alone to web based systems) in the modern sector health information system (HIS). This data needs to flow across sectors, from the traditional to the modern, without being "lost." Bowker and Star (1999) see classification as carrier of meanings, data, and information across time, space, and different systems. In the process of carrying meanings, histories which include moral and political values are encoded.

Acknowledging the existence of pluralistic health systems (Berman and Rose 1996; Besley and Ghatak 2005; Meessen, Gilson et al. 2011) and the role of external agents (donors, researchers, NGOs, etc.) as factors shaping the HIS; this study looks at the interplay(s) between the modern and traditional health sectors, focusing on understanding their inter-linkages or the lack of it, especially where data flows are concerned. The way data generated from the two health sectors is collected (or missed) and how these flows impact on data quality of the HIS are key focal points of my analysis. Considering that a health sector, especially primary health care, deals with different health programs such as malaria, tuberclosis, HIV/AIDS, maternal and child, and each with its own information systems (IS) and supporting practices; this thesis focuses only on flows related to maternal and child health (MCH) data. MCH was chosen because at community level, some pregnant women utilise TBAs (26%) and while others (14%) deliver at home (NSO-MDHS 2005).

1.1.1 The Empirical Problem Studied

In Malawi, 80% of the population live in rural areas where there are inadequacies in terms of health facilities, skilled births attendants (SBAs), ambulances, and medical supplies (NSO-MICS 2008). It is therefore, not surprising that some pregnant women deliver their babies using TBAs (Bisika 2008). However, most data generated by TBAs within the rural communities does not find its way into the formal district and national HIS. An earlier study has argued that data that goes into HIS is incomplete because community level data is not included (Galimoto 2007). Data incompleteness has been consistently reported as one of the persisting problems of the Malawi HIS (HMIS 2002; HMIS 2004; HMIS 2006; HMIS 2008), representing a symptom of larger systematic problems within the health system context.

When Malawi health management information system (HMIS) was launched on January 1, 2002 (Chaulagai, Moyo et al. 2005), it was believed it would be the solution for the problem of incomplete and unreliable data. Since the HMIS only collects facility-based data and does not capture all the data that exist in communities (Chaulagai, Moyo et al. 2005), consequently only data of those who visit health facilities for services is captured. An HMIS evaluation done in 2008 (Moyo 2008) revealed that the problem of data incompleteness reported in Chaulagai, Moyo et al. (2005) still exists and the main aim of optimizing data quality had not been fully achieved.

At a broader level, health systems in developing countries tend to be inequitable, providing more in terms of services and coverage to the better-off than to the poor, who are unable to obtain these services (Gwatkin, Bhuiya et al. 2004). There is need for concerted efforts to not only reach the disadvantaged (poor) groups in terms of services and coverage, but also to ensure that data generated is effectively captured. Currently, the traditional health sector which most of the population use is poorly linked with the modern health sector.

1.1.2 Research Motivation

My motivation is to understand the systematic causes of poor maternal and child health data quality in the existing HIS, and how can this be improved. Although literature from 1990s (Azubuike and Ehiri 1999) identified incomplete data as a problem in the health system, the problem still persists. This triggered memories of when I was growing up, a good number of pregnant women were delivering babies at homes (not at health facilities). Most mothers would not bother to take their babies for vaccination (some would use traditional protections (amulets) around their babies necks or waists) although there was a mission hospital within reach. I could relate this situation with the findings in HIS literature and I started to think whether the data generated on births in the villages on births ever finds its way into the HIS. Further, documents (AHWO 2009) do not include the traditional health sector when describing Malawi’s health system. These factors gave me the motivation to explore the adverse implications of missing data on the long-term effects on the health sector if the policy decisions are based on data that does not reflect reality.

1.1.3 Research Significance

The modern component of the Malawi health sector is formally organized over four levels-national, district, health facility, and community (village) level. At the national level the headquarters and the HMIS Unit is hosted. At the district level, there exists Assistant Statistitians who are responsible for periodically (typically quarterly) aggregating health-related data collected from all health facilities within a particular district (Chaulagai, Moyo et al. 2005). The data is captured at health facility level through health registers for different vertical programs and at the community level by community health workers known as Health Surveillance Assistants. The community level is also where most of the traditional health providers operate. Although there are more reform activities being initiated within the modern health sector, it typically impacts a smaller proportion of the population. In Malawi (Lwanda 2002; Zachariah, Nkhoma et al. 2002) and in most developing countries (Green 1994), up to 70% of the population utilise the traditional health sector, typically not affected by the reform initiatives.

Majority in rural communities, where most rural poor reside, utilise the traditional health sector. As a result, substantial data is generated within the traditional health sector, where ironically, data collection mechanisms at the community level remain elusive (Chaulagai, Moyo et al. 2005). Currently, in Malawi there is only one link between the modern and traditional health sectors, the Health Surveillance Assistants (HSAs). In addition to linking the two sectors by way of collecting data at community (village) level and its reporting, the Ministry of Health (MOH) HSAs report indicate that they have eleven other roles. Having structured mechanisms for data collection in both modern and traditional sectors, and strong inter-linkages between the two, therefore, is a requirement for successful collaboration in strengthening data quality and with it the overall HIS. Focusing only on the modern sector, as is typically the case, implies a significant proportion of relevant data is missed out. It can be argued that given the proportion of the population utilizing the traditional health sector and their increased popularity, calls for greater focus on the inclusion of data generated in both the sectors of the health sector for the HIS to be comprehensive.

Further, as the year 2015 approaches, the pressure for National Ministry to achieve the three health related Millennium Development Goals (MDGs) – four, five, and six – is increasing. Out of the eight MDGs, two (fourth and fifth) are specific to improving child and maternal health (UN-MDG 2008). The information generated by HIS is the means for measuring the achievements towards the MDGs targets. According to Travis, Bennett et al. (2004), the High Level Forum on achieving the Health MDGs identified weak ISs as one of the major constraints. This reaffirms the critical need of HIS with quality data. While HIS appears to be one of the prerequisites to achieving the health MDGs, there are various complexities and factors that impact on the way HIS data is generated, collected, and processed. For example, the drive to produce results for the MDGs has led to policy for maternal and child health program. The Maternal and Neonatal Health (MNH) Program and MDGs advocate that every pregnant woman seeks care from skilled births attendants (formally trained from a recognized medical or nursing school), whereas before the 1978 Alma Ata Declaration (WHO-UNICEF 1978), there was the trend in promoting TBAs due to shortage of personnel in the modern health sector (Kaboru, Falkenberg et al. 2006). Although skilled personnel are being promoted, issues of affordability, access (Kadzandira and Chilowa 2001) and inadequate provision of rural health services (Lwanda 2002a) comes into play, implying the continued reliance of most rural pregnant women on traditional providers.

Though I acknowledge that increasing the number of professionally trained (what I here after refer to as *skilled*) personnel helps to address the issue of missing data and data quality problems; the context of the study highlights other problems. Lack of vital registration, national identitification systems, and physical addresses also contributes to the complexity of missing data. In the absence of vital registration; population census and survey figures are used as denominator values (HMN 2008) when processing the data for health indicators. However, population census and survey is like record keeping; what is recorded may be viewed as impartial and thus also incomplete unless its social nature is well understood. This is a powerful reminder that much as we trust in numbers, they are not always consistent with our premises (Porter 1995). Other than the inconsistencies that census and survey figures may have, some of the collected data may be lost as it is passed from one administrative level to the next. Missing data in this thesis therefore refers to data from both the modern and traditional health sectors which has not been collected or data which has been lost after collection and did not find its way into the HIS, and the ensuing collective statistics. An analysis of aspects that cause data to miss in HIS are crucial. However, just as it is important to consider data from both traditional and modern health sector, it is also important to look at both the quantity (or coverage) of data (whether all relevant data has been collected) as well as its quality. In the health sector, data quality matters most and the missing data compromises data quality. Whilst acknowledging the importance of facility-focused policy, “context-specific service and community-based strategies” for maternal services is given as a better alternative. Costello, Azad et al. (2006) give Bangladesh and Malawi as examples where concentrating on the modern health sector alone has not been sufficient.

1.2 Research Aim and Questions

The introduction describes gaps in both practice and research. These gaps include missing maternal and child health data and lack of community focus for IS initiatives. The identified research gap, which is also true in the case of South Africa (Byrne 2004) and Nigeria (Yokoyama and Kunyanga 2007), concerns the understanding of how data generated at community level is collected (or missed) with respect to the national systems. The thesis therefore **focuses on** understanding the nature of linkages between the modern and traditional health sectors where data flow is concerned, using the **premise that** excluding data from traditional health sector impacts on HIS data quality of the broader system. The **aim** is therefore to explore measures that can be put in place to strengthen the link between modern and traditional health sectors. Being restricted to the reproductive health sector, traditional healers and spiritualists are not considered.

Further, I wanted to explore the relationship between knowledge created from traditional practices and how it can be shared and utilized to improve the quality of health data which goes into HIS. Drawing from Puri (2003), the following underlying assumptions inform the research:

(i) Involvement of members of community in processes of data capturing and policy-making can improve the visibility and quality of data that flows from community to health facility levels, and in turn improve the overall data quality in HIS.

(ii) The fact that locally generated knowledge within communities and traditional practices are not seen as important as the scientific knowledge and modern practices of decision makers and policy implementers, undermines the data generated within the traditional health sector. This has a strong influence on the way the traditional health sector is perceived.

1.2.1 Research Questions

Within the health sector of developing countries, a multiplicity of factors affect HIS data quality. Using maternal and child health data, the following research question derived from the identified gaps and underlying assumptions will guide the study:

> *What is the nature of and the effectiveness of the linkages for maternal and child health data between the traditional and modern health sector?*

The question has been further broken-up into three questions, the first question will assist to identify factors that affects data quality.

(i) *What has an impact on maternal and child health data quality in the Malawi HIS?*

Since the health sector comprises of modern and traditional sectors; to achieve good data quality, it is important to include data from both sectors into HIS. Therefore, the following research questions will address the reasons why some data is missed.

(ii) *Why is some maternal and child health data from the traditional health sector (community level) not incorporated into HIS?*

The last question addresses possible ways of strengthening the linkages.

(iii) *What practices and knowledge from maternal and child services within the traditional health sector are valuable for the purpose of strengthening HIS?*

1.3 Empirical and Theoretical Approach

Using Reich's (1995) conceptualization of the need to identify the root cause, I look at how data is generated and flows across the two sets of health institutions (the modern and traditional). I use the lens of community of practices, specifically focusing on the Maternal and Child Health (MCH) data. The dynamics between politics, policy, and governance constructed to inform the health sector and how the intertwining with the health sector affect HIS data quality are explored. Data quality is characterized as a multidimensional concept which includes data accuracy, completeness, consistency, timeliness (Wand and Wang 1996), objectivity, reputation, interpretability, and consistent representation (Strong, Lee et al. 1997). The unit of investigation is the community level MCH health practices in the Malawi health sector, focusing on the community health workers known as HSAs and TBAs.

In order to understand the context of the phenomena, the study started with a situation analysis and literature review to come up with a conceptual reference of the factors affecting data quality in the Malawi HIS. Much as the study focuses on MCH data, knowing the number of children born outside health facilities is outside the scope of this study. It is not about the numbers, but the need to understand the context and revealing the deeper embedded issues – contextual, historical, and institutional causes of missing data which in turn affects the data quality.

An interpretive approach using qualitative methods was adopted in the study in order to uncover the depth and breadth of the practices that lead to generation of MCH data in both modern and traditional health sectors. Data was collected over a two year period from June 2008 to July 2010. Both primary and secondary data was used. The primary data was collected through interviews and observation from traditional births attendants, mothers, community members, health professionals (including HSAs) at three health facilities in Zomba district, the health program coordinators at the district office, and from the MoH headquarters. The secondary data was sourced from HMIS and other reports from the MoH plus National Statistical Office publications and reports.

Theoretically, concepts from the CoP theory were used to establish an understanding of practices across the traditional and modern sectors of the Malawi health system, the flows of data, and the nature of the weak links in these networks. Concepts of boundary connections such as *boundary objects*, *boundary interactions*, and *knowledge brokerin*g (Wenger 1998; Wenger, McDermott et al. 2002) are used. Primarily, CoP theory was chosen because it helps in understanding the creation or not of a social infrastructure that enables knowledge creation and its exchange (Murty 2011). The boundary connections also allows actors to share both domain-specific and common knowledge and also assess each other's knowledge and understand the challenges across respective domains (Carlile 2004). In the health sector, the traditional sector mostly utilises indigenous knowledge whilst the modern sector mostly utilises scientific knowledge and the boundary interactions allows the different knowledge to be shared across. Other than sharing knowledge, data and information is also shared across CoPs (Serrat 2010).

To emphasise the significance of strong linkages across sectors, levels, and to ensure that the knowledge created in one CoP benefits others, the *weak link* concept (Gilks and Spiegelhalter 1996; Goldratt 1997; Flink 2002) is used. In this thesis, a *link* is a boundary connection where two CoPs share practices, knowledge, and data through brokering, boundary objects and interactions. Weak link is an unfathomable issue in the health sector context, because of the inter-relations between the health sector administrative levels; a higher level depends on data generated at lower level, and if the data is not passed on, relevant data can be missed, compromising HIS data quality. Further, the dualism of modern and traditional health sector entails that knowledge (and data) should flow from one sector to the other.

1.4 Expected Contributions

Theoretically, the research extends the CoP theory with the weak link concept which helps to emphasize the importance of strong linkages used to share knowledge and data within the health sector. Practically, clear rules and methods for handling missing data both within traditional and modern health sectors are outlined. The need for countries to come up with effective policies that are locally owned is also emphasized.

1.5 Thesis Organization

This thesis has six chapters and is organized as follows: Chapter two gives the research context in terms of the physical and social aspects and gives a description of the health care system in Malawi, with a focus on the urban-rural discrepancies. Chapter three gives a frame of references based on literature review. The chapter starts with related literature from IS and HIS research disciplines followed by a description of the theory and concepts used for analysis and discussion. Chapter four looks at the methodology adopted in this research and the case description. The epistemological lens, research design, the data collection methods, and the analytical tools used are discussed in this chapter. Chapter five is about the research findings and analysis. These are presented as summaries of research paper publications. Chapter six is the discussion, interpretation and explanations of the findings. The chapter ends with some recommendations and concluding remarks.

2 The Research Context

The study was conducted in Malawi, a developing country in sub-Saharan Africa. In this chapter, a background of the social and economic construction of Malawi is provided to contextualise the research and provide readers with an orientation to some of the factors which influence the current health sector situation. The research context has a significant rural-urban dichotomy with demographic, economic, and geographic disparities. Demographically, most people reside in rural areas; economically, most rural people are poor. Despite the higher population in rural areas, availability of health facility infrastructure is asymmetric, with more available in urban areas.

2.1 Malawi's Geography

Occupying a land area totaling 118,480 sq.km, Malawi borders with Tanzania on the north and northeast; Mozambique on the east, south, and southwest; and Zambia on the west and northwest. It is part of the Great Rift Valley of East and Central Africa. The country has a total population of 13.1 million, of which over 81.2% live in rural areas (NSO-MPHC 2008). Almost half (47%) of the population is under the age of 15. The adult literacy rate is 66% (AHWO 2009). Administratively, Malawi is divided into three regions; north, center, and south. The three regions are divided into 28 districts. Each district is further divided into traditional authorities (T/A). The T/As comprise of villages which is the smallest administrative unit headed by a village head man or woman known as a *mfumu* (chief) (NSO-WMS 2008).

Malawi's climate is characterized by three seasons - dry-hot from August to November; cold-dry during the months of May to July; and wet/rainy from December to March. The wet season is characterized by tropical rains when most of the unpaved roads, particularly in the rural areas become slippery and muddy. In this season, transmission of data is adversely affected. Infrastructure in Malawi is poor. Only 35% of the roads are in good condition (less during the wet season), and motorized transportation is often unavailable in rural areas.

The communication infrastructure, particularly the fixed public telephone system, is also poorly developed, particularly in rural areas. However, in line with the mobile phone revolution elsewhere in Africa (Cf. (Etzo and Collender 2010) Malawi has seen a phenomenal rise in the rural availability of mobile phones, making it an attractive potential medium for the transfer of data between HSAs and the district (Manda 2009).

Malawi has 6% electrification rate and this poses challenges for rural people both in lighting and cooking as well as in charging their mobile phones. Health facilities in rural areas where there is no electricity find it difficult to retain staff since most of them prefer where there is electricity. However people are enterprising and use a variety of methods to charge these, overcoming the many electrical power blackouts. Alternative power supplies include generators and solar panels. Even in parts of urban areas, piped water is not available and 35% of the urban population cannot afford to pay for the piped water (Mulwafu, Chipeta et al. 2003). However, bore hole drilling scheme has made some inroads into providing portable water to rural areas.

Malawi has varying customs, beliefs and traditions. Most within the Bantu cultural continuum but some syncretic forms have emerged which mix Christian and Islamic traditions with indigenous forms (Cf. (Kamowa and Kamwendo 1999; Lwanda 2005). These have a strong daily influence on Malawians and help to determine the acceptability of modern practices and ways of life such as in the domains of agriculture, education, family planning and modern health care (NHA 2001).

2.2 The Health Care System

Malawi's 'formal' health care system was introduced by missionaries and dates back to the 18th century (Pachai 1972). Malawi health sector other than having two broad divisions (modern and traditional), has a hierarchical structure comprising four levels: Ministry of Health (MoH) headquarters, district, health facility, and community level. Within the modern component, there are various categories which include: public and private health providers who provide primary, secondary, or tertiary healthcare. The traditional health providers include TBAs and traditional healers, who provide 80% of the healthcare to the population (Lwanda 2002). The modern part of the health sector has a total of 1030 institutions across the country (see table 1). Of the total, 82% provide basic services – primary health care and only 1% provide tertiary healthcare.

Table 1 – Total number of health institutions in Malawi and service coverage

Health Services Provided	**Total Number of Institutions**	**Percentage (%)**
All Institutions	1030	100
Institutions offering primary health care only	850	82
Institutions offering primary and secondary health care	98	16
Institutions offering primary, secondary and tertiary health care	6	1
Administration, project, research, & training institutions	76	7

Source: (MoH-CSR 2007; NSO-MPHC 2008)

Compared to the population size of Malawi, there is a shortfall of health facilities, particularly those offering secondary and tertiary care. Any large influx of referred cases from primary to secondary or tertiary healthcare, therefore, can cause problems. These problems are magnified by shortage of staff offering secondary and tertiary services as shown in table 4. Failure to access secondary or tertiary services may discourage pregnant women from utilising health facilities. Tertiary services in rural areas are provided through CHAM hospitals and these too face similar experiences of staff shortages, to long waiting lists.

The health institutions belong to different owners, including: government (owning 60% of the institutions), Christian Health Association of Malawi (CHAM), and some NGOs. Table 2 indicates the percentages of ownership and the health services provided by each owner. Other than MoH, the Ministries of Agriculture and Education also provide health services. In addition, there are services for specific target groups such as the armed forces, prisons and police (Banda, Makombe et al. 2008). Only government-owned (public) institutions offer free services making it more challenging for the rural (poor) communities to get services even in cases where the distances to private and CHAM facilities are reachable. As a default alternative in cases where people cannot access or afford the health services, they end up utilising traditional providers, and pregnant women end up utilising TBAs.

A census conducted in December 2007 revealed that an average facility to population ratio of 1:13,824, while the ratio in rural areas is 1:14,749 and that in urban areas is 1:9,870. The population to facility ratio also varies across districts, with the highest having ratio of 1:23,942 (MoH-CSR 2007).

Table 2 - Health Institutions Ownership and Services Provided

	Institutions Owned	Services Provided
Government	50%	60%
CHAM	16%	30%
Private Institutions	20%	3%
Other	14%	7%

Source: (MoH-CSR 2007; NSO-MPHC 2008)

Coupled with health facility shortages, there is also shortage of human resources, drugs and diagnostic services. The human resource shortage in Malawi health sector is one of the severest in sub-saharan Africa (WHO 2008) as evidenced by high vacancy rates in critical health care positions (see table 3).

Table 3 – Vacancy Rates for Health Professionals in Malawi

Year	Doctors	Nurses	Clinicians	Source
2004	68%	58%	32%	(UNDP 2009)
2008	62%	76%	70%	(MoH 2008)

With health staff shortages, patient to health personnel ratios are very high. In some cases, the patient is not given as much time, which discourages some of the patients from visiting health facilities. In 2004, 68% vacancies of doctors, 58% of nurses, and 32% of clinician positions were unfilled leading to situation with 2 doctors and 28 nurses to every 100,000 Malawians (UNDP 2009). Whilst the numbers improved slightly for doctors, table 3 shows that the vacancy rates for nurses and clinicians increased by 2008. With such high vacancy rates, 50% of health facilities in Malawi, particularly in rural areas, have less than 1.5 nurses and 4 districts do not have any doctor (Ngoma 2009). The health centers are staffed by community health workers called Health Surveillance Assistants (HSA) with only 10 weeks of training (Sanders, Todd et al. 2005).

A fact relevant to this thesis is that in 2007 of the 33,766 health personnel in Malawi; 30% were HSAs, 29% management and support staff, 13% nurses, 4% technicians, 2% clinical officers, 2% medical assistants, and 1% physicians and only 64% of the total were employed by government (MoH-CSR 2007). This illustrates that only 22% of the health personnel are fulltime in health facilities. HSAs contribute 30% of the health personnel work in both community and health facility levels. These percentages confirm the staff shortages also contribute to pregnant women utilising TBAs.

Most of the health personnel play a role in HIS. HSAs are the ones responsible for capturing the data generated at community level. The data at health facility level is captured into different registers (i.e. outpatient, maternity, ward admissions) by nurses, clinical officers, medical assistants, and physicians. The officer-in-charge at health facility level is also responsible for compiling the data from different registers on a quarterly basis and sending this to district level. At the district level, assistant statistians is responsible for compiling data from different facilities and sending this to MoH headquarters. However, the shortage of health personnel limits the way data is captured. For example, instead of HSAs collecting data on a daily basis, they collect on a monthly basis (see Paper I) and data at health facility is sometimes captured by non-professional staff and is error prone.

The Malawi healthcare system has a multiplicity of providers which also results in fragmentation of the different information systems contributing to incomplete and unreliable data (Chaulagai, Moyo et al. 2005; Kanyimbo 2006; Galimoto 2007). The absence of reliable data is a major weakness of the HIS in Malawi (Chaulagai, Moyo et al. 2005) and poses challenges for planners and decision makers as there is reluctance to use it.

2.2.1 Urban-Rural Divide in Health Sector

Although the Malawi Human Resources for Health Country Profile (AHWO 2009) clearly states that an efficient and effective healthcare delivery system, among other things, depends on equitably distributed health workers; this is far from being achievable in the Malawi health sector. As alluded to in the section above, there is asymmetry in the way health facilities, human resources, and services are distributed between the urban and rural areas, in favour of the former (see table 4). The only exception is the community health workers where the urban-rural HSA ratio is 21% to 79% which is almost the same as the urban-rural population ratio. However, the data collection mechanisms still remain elusive at the rural community level (Chaulagai, Moyo et al. 2005).

Table 4– Urban-rural discrepancies

	Urban	Rural	Total	Source
Malawi population	18.8%	81.2%	13066320	(NSO-MPHC, 2008; WorldBank, 2010)
Generalist medical practitioners	77%	23%	190	(AHWO, 2009)
Specialist medical practitioners	95%	5%	67	(AHWO, 2009)
Nursing professionals	71%	29%	2928	(AHWO, 2009)
Nursing associate professionals	60%	40%	968	(AHWO, 2009)
Paramedical practioners	79%	21%	1881	(AHWO, 2009)
Environmental and occupational health and hygiene workers	75%	25%	318	(AHWO, 2009)
Zomba population	87366	583167	670533	(NSO-MPHC, 2008)
Rate of access to safe motherhood services	70	51	61	(MNPI, no date)
Rate of delivery care	76	58		(MNPI, no date)
Rate of obstructed labor	72	43		(MNPI, no date)

2.2.2 Health Sector Reform in Malawi – Programs and Policies

In an effort to improve the healthcare system, a number of initiatives have been initiated, including decentralization and sector-wide approach. In 1970, the United Nations Population Funds (UNFPA) introduced programs to support the TBAs as a way of improving maternal and child health (UNFPA 1996).

In the early 1990s, a major reform took place at service delivery level with the introduction of Health Passports which recorded patient history and was owned by the patient. Health passport initiative improved the way patient records and history was kept and it was reported to have ‘revolutionalised patient care in Malawi’ (Ngwira 2005). Prior to the health passports, cards were being used, where each patient’s card would be opened and kept at health facility where service was provided. This resulted in a situation where a person would end up with multiple cards depending on the number of health facilities the person utilised, making the tracking of patient history a big challenge.

In 1994, Malawi adopted the National Population Policy in a bid to improve family planning and healthcare programs (AHWO 2009). The policy aimed to regulate population growth to make it compatible with Malawi's social and economic goals (NSO-MDHS 2005; AHWO 2009). Despite being a policy for regulating population growth, no mechanisms were put in place to ensure that data of births is captured on a daily basis, especially by TBAs, resulting in not recording data for babies born at home or TBAs. Walt and Gilson (1994) articulates that many health policies "wrongly focuses attention on the content of reform, and neglects the actors"; this policy suffered from the same. In 1998, a Local Government Act for decentralization was introduced (MoLG 1998; AHWO 2009). Following this, the three Regional Health Offices which existed in the 1997/98 financial year became defunct (Banda, Makombe et al. 2008) and responsibility was passed on to District Health Management Teams (DHMT) at District Health Offices (DHOs) located at the MoH district hospitals (Banda, Makombe et al. 2008). With the mandate to supervise all health facilities within a district, the DHOs lacked the prerequisites for making decentralization work such as: internal commitment to transformation, informed and involved citizens, and accountability (Cross and Kutengule 2001). It was thought that DHO functioning could however be improved with the promotion of community-based activities such as the one used by NGO-managed projects (Cross and Kutengule 2001). However, little practical consequence emerged due to the fact that the decentralisation process was largely externally induced by donors and the existing associational structures did not favour it (Cross and Kutengule 2001). With decentralisation successfully implemented, DHMTs would have devised mechanisms of capturing data and following up missing data within their jurisdiction.

In 1999, the MoH launched the National Human Resource Development Plan (AHWO 2009). The aim of this plan was to ease the problem of staff shortage which has repercussions on the way data is collected or missed within health facilities. Much as the plan was launched, it achieved very little results due to staff shortages (see table 3). In the same year, the fourth 5-year (1999–2004) National Health Plan of Malawi which included the restructuring of HIS was put in place (Chaulagai, Moyo et al. 2005). The data quality issues being discussed in this thesis is through introduction of this HIS.

In 2003, MoH established the Health Services Commission to forsee recruitment, appointments and promotion of health workers (AHWO 2009) and in 2004 an Essential Health Package (EHP) initiative and sector-wide approach (SWAp) program were introduced

(Chaulagai, Moyo et al. 2005). SWAp was a way of rationalizing the use of funds whilst the EHP initiative was a way of improving access to services (Ngwira 2005). The Commission reported some positive results with the number of HSAs increased from 5,040 before 2006 to 10,500 by 2010 (Katsulukuta 2010) and nurses incentives by topping up their salaries by 52% and locum by 100% (Ngoma 2009).

In 2007, the MoH introduced the Sexual and Reproductive Health and Rights (SRHR) policy with aim to reduce maternal and child mortality rates in line with the MDGs, particularly MDG four and five – improving infant and maternal mortality respectively. Among other things SRHR policy redefined the role of the TBAs from delivering babies to advising and motivating mothers to appreciate the need to go for skilled births attendants (SBAs) at health facilities (MoH 2009).

Although all the reforms had one goal (to improve the health of Malawians); not all reforms have achieved their full potential. For example, the TBA support reform was later countered by the implementation of SRHR policy which meant TBAs stopped conducting deliveries. The health passports have their own limitations where HIS is concerned, as they only capture details of patients accessing the modern health sector. Absence of National Identities and physcical addresses hinders the National Population policy to realise its full potential. The SRHR policy is detered with the realities of health facility infrastructures and health staff. Although SRHR policy aimed at encouraging pregnant women to have institutional deliveries assisted by skilled births attendants (SBA), limited number of health facilities coupled with staff shortages posed as a big challenge. With the shortage of SBAs within health facilities, only 56% of those women who access health facilities were assisted by SBAs at birth (Kamwendo and Bullough 2005).

2.2.3 Basic Health Indicators

Malawi has poor health indicators, especially for infant and maternal mortality rates (see table 5). . Although the maternal mortality rate (MMR) has declined considerably since 2000, there is need for a steeper decline to meet the MDG target of MMR of 155 by 2015 (NSO-MDHS 2005; NSO-MICS 2008). The MMR for Malawi was reported at 807 in 2006 (NSO-MICS 2008) and declined to 510 in 2008, according to estimates by the WHO (Nove 2011). Much as these are official statistics, these indicators require more subjective data, collected in a way that conforms to the practices and patterns of the community. This research therefore contests the reliability of the official figures.

Table 5 –Health Indicators

Indicator	**Year**	**Value**
Life Expectancy (for both male and female) (years)	2004	41
Maternal mortality ratio (MMR) (per 100,000 live births)	2006	807
Under-five mortality rate (per 1000 live births)	2006	118
Institutional deliveries assisted by skilled births attendants	2004	56%
Institutional deliveries assisted by patient attendant	2004	1%
Deliveries assisted by TBAs	2004	26%
Deliveries assisted by relative or friends at home	2004	14%
Proportion of births occurring in rural areas	2004	87%
Proportion of births occurring in urban areas	2004	13%

Sources: (NSO-MDHS 2005; NSO-MICS 2008; UN-DESA 2009)

The MDG of improving maternal health is measured by two indicators—the MMR and the proportion of births attended to by SBA. However, table 5 indicates that not all institutional deliveries are assisted by SBAs, with 26% of births are assisted by TBAs and 14% by relatives and/or friends at home. In addition, the total fertility rate per woman in the age group of 15-49 years is high at 4.5 in urban and 6.6 in rural areas (NSO-MICS 2008). It is important to note that fertility rate also affects maternal mortality; lower fertility reduces maternal mortality (Banda, Makombe et al. 2008; MoDPC 2010). In this case, the high fertility rates that may lead to high MMR given that SBA deliveries are low, makes it more challenging to implement the SRHR policy. This leads to a situation where a substantial percentage of pregnant women continue utilising TBAs. Consequently, data of births at a TBA or at home ends up being missed.

2.3 HIS Implementation in Malawi

Going by the definition of an IS which is ‘an integrated set of components for collecting, storing, processing, and communicating information (Britannica), Malawi had a semblance of a HIS as early as 1912 (Vail and White 1975).

> During the 1920s, the British were especially eager to implement a system of formal Indirect Rule. Chiefs and headmen in all districts of Nyasaland already played a considerable part … in 1912, the

> passage of the District Administration (Native) Ordinance (DANO) had provided for the appointment of Principal Headmen and subordinate village headmen to whom would be delegated minor responsibilities for the general conduct and welfare of village life and for keeping the district officer informed of births, deaths, … (Vail and White, 1975, pp. 158).

Although the IS referred to by Vail and White contained a wide range of administrative data, some of it related to health; such as of births and deaths. The difference with the current HIS being that the data then was collected by chiefs and channeled through the district officers currently known as district commissioners (DCs) who were the chief executives for districts. Today the data for HIS is collected through health facilities and the DHOs.

As mentioned earlier, Malawi HIS reform process was introduced in 1999 as an effort to further improve the healthcare system and health management information system (HMIS) was introduced in 2002 across the country. Although the health system has community as the lowest level, the HMIS data collection tools had the health facility (sub-district) as the lowest level. Although some communities have village health registers, they are not functional. HSAs are responsible for collecting data from the communities on a daily basis. However, they face significant challenges including: work overloads, transportation, and large catchment areas. As such, HMIS data collection methods at community level remain elusive, since the village health registers are not being used. HMIS uses both electronic and paper-based systems. At district and national levels, they use an electronic system, and the district health information system (DHIS v. 1.3) is the software application used. At the health facility level, a paper-based system is used and they use loose forms when reporting the data to the district level. The officer in charge of each health facility compiles data on a quarterly basis and submits the reports to the HMIS statistician at the DHO (Galimoto 2007). The HMIS statistician aggregates data from all health facilities within the district and compiles quarterly reports which is then submitted to the central HMIS office.

Acknowledging the shortfalls of the initial “one size fits all” HMIS implementation approach which led to more fragmentation of the vertical program information systems; the HMIS is now being adopted based on a data ware house approach since 2009 (Kanjo, Braa et al. 2010). This is being implemented using an iterative approach using the web-based DHIS v2.

2.3.1 Role of the Health Surveillance Assistants (HSAs)

HSAs, with only 10 weeks training, are responsible for supporting several villages within the health facility catchment area covering a population between 3000-6000. The HSAs are the only (formal) link between communities and health facilities (Kadzandira and Chilowa 2001). The focus of HSAs is on preventive care, advising and counseling communities and supporting provision of outreach services like immunizations. They are also responsible for recording local health data (including deaths and births) on a daily basis from the communities they serve.

HSAs are supposed to come from the communities within which they work, but this is not always the case. HSAs report to the health facility officer in charge who is usually a medical assistant or a nurse. HSAs are over-burdened with different tasks. This poses as a challenge when it comes to collecting and recording all the data consistently. Each HSA is responsible for several villages within a health catchment area. Prior to the introduction of the SRHR policy, HSAs collected data relating to pregnant women and births from trained TBAs report books and birth registers within communities. This was done on a monthly basis. Once the SRHR policy was introduced, HSAs are supposed to capture data from communities on their own, not through TBAs despite having limited transport to assist them cover the wide catchment area.

2.4 Governance and Political Systems within Malawi and Health Sector

Within the Malawi set-up, governance of the public sector is intertwined with political processes. The health sector as part of the public sector is no exception, to its systems of governance being not independent of political influences. The introduction of multi-party rule through a referendum in 1993 was seen by some as an opportunity to increase decentralisation. However, the centralisation imperative, both a legacy of the one party era and a product of the new neo-patrimonial patronage system, has twarted moves towards increased local government. In fact, local government elections have not been held since 2000 (Cf. (Kaunda 1999; Tambulasi 2010) stalling the decentralisation process.

Thus, despite the rhetoric of political decentralisation, it remains limited at the political level and also within the civil services. Most decisions in the MoH still require to be referred to the MoH headquarters, for example the supplies to the health facilities. External observers have attributed some of these centralising tendencies to culture (Forster 1994) and lingering traditionalism (Chabal 1997) while Malawian observers emphasize the role of politics, and that since the time of political change in 1994, the country had not undergone a 'de-autocratisation' (Mapanje 1995).

Examining the decentralisation of government functions, Cross and Kutengule (2001) found that there is still lack of genuine internal commitment by Malawi's political leaders to transformation from central to decentralised governance, with limited accountability, citizenry lack adequate information and involvement, they are not represented effectively, and local government is not financially empowered.

The slow pace in decentralising government functions have impacted the health sector as well, particularly at lower levels (Cf. (Kanyinga 1998; Cross and Kutengule 2001) where the rural communities are tied to sources of social power such as of politicians and *mafumu* (chiefs). The Chieftainship institution was retained after a cabinet crisis in 1994 by Banda (the then president) who based Malawi's democracy on the old African institution which included retaining chiefs (Forster 1994). To date, chiefs still retain much of their traditional legitimacy (Swidler 2010). However, where they oppose party decrees (politicians) they risk being dismissed (Cross and Kutengule 2001). This has led to increased apathy and withdrawal from involvement in local activities at the village level.

In the health sector, withdrawal from local activities was noticeable on the part of TBAs when SRHR policy in 2007 stopping them assisting pregnant women to deliver babies (MoH 2009). One of the concerns with the policy is that, as is the case with many policies, it is implemented top-down without the involvement of the rural communities (Buse, Mays et al. 2005). Yet for such a policy to achieve the desired strategic impact, involvement of rural communities, having additional health facilities and personnel is required. Reality remains that most households marginally benefit from the modern health sector and resort to traditional health providers (Lwanda 2002a). Poverty, still a growing problem in Malawi (Chinsinga 2002; WorldBank 2012) also brings into play both politics of poverty and "politics of power" (Englund 2002) allowing politicians to take advantage and push for their own agendas.

2.5 Administrative Divisions across Sectors in Malawi

Administrative divisions in Malawi vary depending on sector and are worth noting in the context of this study. This makes it difficult to have accurate figures for population per village, per community and per health catchment area. The National Statistics divisions (the office from where projected figures come) are different from the Health sector divisions. The areas are different from the lowest level, for example, the lowest level National Statistics divisions known as *enumeration areas* cuts across villages within the health catchment areas. As a result, the health catchment areas do not have population data.

The agricultural sector is divided into three levels - agricultural development divisions, rural development projects and extension planning areas. The education sector is also divided into divisions, education districts, zones and schools. Politically, the divisions are parliamentary constituencies' first, then local government wards. Depending on parties, some further divide into branch and area levels. The National Statistical office is responsible for government figures through population census and surveys and divides the country by region and district (and within districts there is a distinction between rural and urban areas). Rural areas are further divided into traditional authorities whilst urban areas are divided into administrative wards. Both traditional authorities and administrative wards are further divided into enumeration areas (see Figure 1).

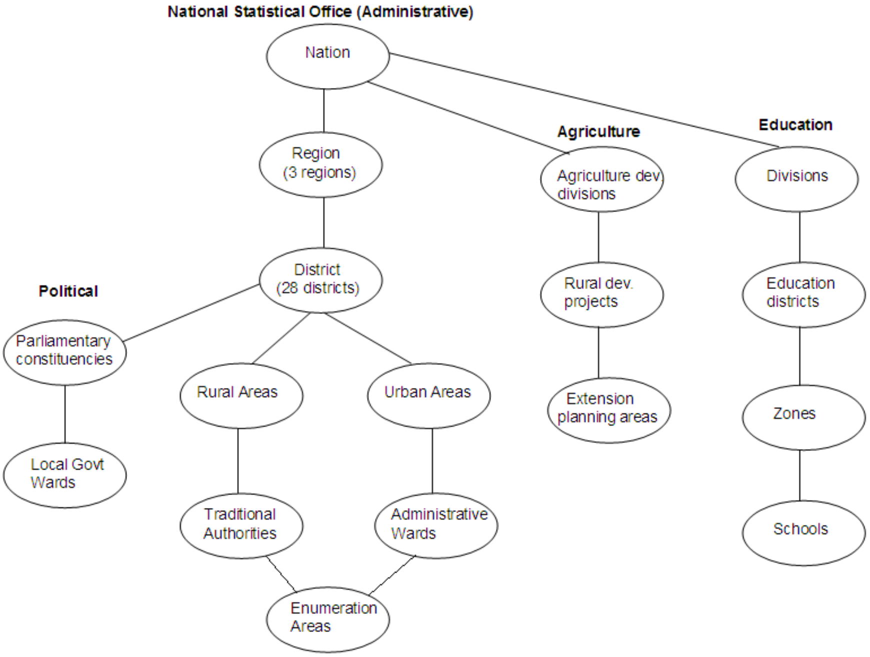

Figure 1 - Spatial Hierarchies used in Malawi

2.6 Summary

The chapter has provided an overview of the context in which this research was conducted. Malawi's geography, the healthcare system background and the existing urban-rural divides that may have an influence on this research have been discussed. Governing policies that relate to MCH data and related governing and political systems have also been described. Within the context, health sector cuts across four levels: headquarters, district, health facility, and community level. The different socio-economic, cultural and political domains described helps to position issues of missing MCH data in context, particularly from the rural community context.

3 Theorizing Missing Data in Context

This chapter presents concepts and theoretical perspectives which help to address the research questions posed in this thesis. In developing my theoretical perspective, I draw upon three key strands of research: i) Community of Practice (CoP) theory; ii) *Feminist discourses;* and iii) *Weak link* concept. These are briefly introduced.

The notion of CoP (Lave and Wenger 1991; Brown and Duguid 2001; Wenger, McDermott et al. 2002; Roberts 2006) helps to understand the nature of participation and the way knowledge and data (Tuomi 1999) is generated and shared amongst individuals within a group (community) with similar concerns and goals. Feminist discourses (Haraway 1991; Adam 2001; Kvasny, Greenhill et al. 2005; Trauth, Quesenberry et al. 2005)provides insights of how social roles such as gender impacts on the practices in communities and knowledge.

I draw upon these insights to understand issues around data and its utilisation in HIS. The *weak link* concept (Goldratt 1997) helps to highlight and explain the “complementarity and linkages” (Jones 2006) of knowledge and data flows between different nodes, in my case the traditional and modern health sectors, and the emphasis on the need to have strong links across CoPs, health administrative levels and sectors. The inter-relation between these conceptual ideas help to understand the how, where and why around missing data in the health sector, and provides the conceptual foundation for the development of a theoretical framework.

The chapter is organised into five main parts. The first part discusses related IS and HIS literature. The next section discusses the CoP concepts used and their role in creating relevant knowledge for data generation and reporting and how it impacts HIS data quality. The third part analyses relevant feminist discourses, looking at the colonial history, issues of marginalisation, traditionality, and the politics of knowledge. The fourth part provides an additional theoretical concept of the weak link. The last part presents the proposed theoretical framework by analysing the concepts used together.

3.1 Related Research

The study falls in the IS research discipline, specifically HIS in developing countries. While ISs are discussed in relation to development (Madon 2000; Heeks 2006; Thompson and Walsham 2010), an IS or HIS with incomplete data cannot contribute effectively to development. Data completeness is one important dimension of data quality (Strong, Lee et al. 1997) and IS success (DeLone and McLean 1992). HIS is one such IS present in the public health domain discussed above. In most developing countries HIS however, fail to provide reliable information (Heeks 1998; Braa and Blobbel 2003). Despite the fact that one of Krickeberg's (2007) eleven principles state that "HIS must comprise clear rules and methods for handling missing … data" (p.15), most HIS remain "overly optimistic and prescriptive" (Sahay, Monteiro et al. 2009) and fail to take "the context" (Heeks 1998; Mumford 2000; Avgerou 2001; Avgerou 2010) into account to ensure that complete information is produced.

IS development is not just about the technical aspects, it includes social aspects as well. One can develop a highly technical IS but if it does not meet the requirements of the client, it can be rendered useless. An understanding of the social and organisational context (Walsham 1993; Avgerou 2007), developed through engaging in the daily practices of the users in the environment is important. Insight into social situation and issues can be gained by utilizing social theory (Walsham 1995) such as CoP. IS field have limited theories of its own. However, different theories have been borrowed into IS research from other disciplines.

IS design and development takes place in different environments. These environments may have a multiplicity of knowledge systems (i.e. scientific and indigenous). Within the same application domain, social-economic capacities also vary. Examples of IS research conducted in an application domain with multiple knowledge systems include the use of GIS for land management applications in India (Puri 2003; Puri 2007). In this case, the indigenous knowledge from communities who inhabit in the land was just as important as the scientific knowledge. Therefore the practices responsible for the communities' knowledge construction and use were analysed using CoP theoretical concepts. The health domain like the context where use of GIS for land management was applied, has a multiplicity of knowledge systems and different social-economic and cultural levels. Indigenous knowledge from different communities within the health sector complement the scientific and technical knowledge utilised in IS (and HIS). In most developing countries HIS, focuses on the health facility and Community-Based HIS are virtually non-existent (Byrne 2004; Yokoyama and Kunyanga 2007).

To understand the way knowledge is constructed, the social make-up of the context is essential. One important social classification is gender. It is therefore important to uncover the influence of gender on the way knowledge is constructed, data developed and the impact of IS development. Although feminist perspectives are a modus operandi for life, it is not sufficiently represented in gender and IS research (Trauth, Huang et al. 2006). Trauth et al. (2006) propose problematising gender in IS research.

3.1.1 HIS in Developing Countries

The complexity, heterogeneity, and existence of multiple realities of HIS (Braa, Monteiro et al. 2004) necessitates that the context be taken into consideration, and warns of adverse implications when social aspects tied to the local context are ignored (Lungo 2008). Existence of multiple realities is evidenced by the different sectors, administrative levels, service providers, programs, and information systems (Mosse 2005; Sahay, Monteiro et al. 2009) and governance and policies are significant determinants. For example, whilst the international level policies of the World Health Organization (WHO) has been advocating for collaboration of modern and traditional health sectors since 1977 (Kaboru, Falkenberg et al. 2006); politics of the different vertical programs means that they are busy promoting their own information systems (Kanjo, Moyo et al. 2009), thereby aggravating problems of fragmentation. That notwithstanding, developing countries have to consider global requirements (such as donor needs, global policy goals), and at the same time, satisfy their local requirements. Striking the balance between global and local goals is complicated. Individual nations do not have total control of the global requirements (Westrup and Al-Jaghoub 2008) and it is more challenging to create possibilities to improve life conditions in a particular locality amidst the global socio-economic order (Avgerou 2008).

Most developing countries (particularly in Africa) have complex health systems (Kleinman 1980) with HIS that produces unreliable (Sahay 2001) and mostly unsustainable data (Kimaro and Nhampossa 2007). This is partly due to the manifestation of dilemmas between modern and traditional health sectors (Zeichner 1988); misalignment of interests, roles, and responsibilities amongst donors, MoH, and developers (Kimaro and Nhampossa 2007); and in some cases due to design and reality gaps (Heeks 2002; Lungo 2008). Another factor (common to all forms of IS) is that people “tend to work where the money is rather than where the problems are” (Heeks 2009): p.23). The world is not fair; most problems occur where there is no money. In the health sector, most problems emanate within the rural communities where there are more people and less resources. Within the public health perspective, it is therefore important to focus on the less-privileged and marginalised groups

(Walsham, Robey et al. 2007). This research has a special focus on the traditional health sector at community level, a marginalized group in its own right.

The need for developing an appropriate HIS has been increasingly emphasized as strategy to achieve the MDGs. However, complexity in a HIS is compounded when integrating data from different health sectors and providers that have different social histories and institutional arrangements (Piotti, Chilundo et al. 2006). The communication is mostly vertical with limited horizontal communication (Damitew and Netsanet 2005). Further in some cases, communication practices surrounding the collection, analysis and transmission of data up and down the various health sector levels are informal, locally specific, and takes place in an improvised manner (Mosse and Sahay 2003; Nyamtema 2010).

3.1.2 Data Quality within the Health Sector

The issue of data quality is complex, deep-rooted and multiple factors influencing it. In most cases, data quality is treated as an intrinsic concept, independent of the context in which it is produced and used. Focus on intrinsic aspects of data quality alone fails to solve other complex and broader data quality problems that are contextual and representational (Strong, Lee et al. 1997).

In the health sector, factors affecting HIS data quality are both historical and institutionally embedded, including organizational, behavioral, and strategic issues (Mettler, Rohner et al. 2008). For example, the belief that maternal mortality will best be reduced by having institutional deliveries (WHO 2005; Costello, Azad et al. 2006) tends to overshadow other causes of maternal deaths (such as infection), some of which happen “outside the intrapartum period” (Costello, Azad et al. 2006). In such events, institutional delivery may not be a solution to capture such data. Kadzandila and Chilowa (2001) mention factors such as lack of resources, shortage of health personnel, poor health facility infrastructure, long distances to health facility, elusive data collection mechanisms are accepted *de facto* as causes of poor data quality. Factors affecting data quality can also be processual. Much as health services within facilities may be strengthened, they have little effect on the rural poor people (Costello, Azad et al. 2006) who cannot afford them. Further, in many low-income countries, emphasis is on antenatal care ending up with discordance between those attending antenatal care and those giving birth at a health facility (Kulmala, Vaahtera et al. 2000). Furthermore, institutional delivery in low–income countries might be delivery assisted by a ward attendant (Kulmala, Vaahtera et al. 2000), who may also not record the data.

3.1.3 Formal and Informal Influences in HIS

Each of the two health sectors have their respective formal and informal instititutions. Formal institutions, are for example, the constitution and laws whilst the informal instutions are like social traditions and practices. By its nature, the modern health sector tends to be more formal than the traditional health sector, for example due to its requirements for periodic reporting and the maintenance of registers. At the two extremes, most reform activities and HIS initiatives concentrate more on the modern health sector such as in Mozambique (Mosse 2005), Zanzibar (Lungo and Igira 2008), Malawi (Chaulagai, Moyo et al. 2005), and Sierra Leone (Sæbø, Kossi et al. 2011). This raises questions whether data from the modern sector is sufficient and objective enough to represent the situation in the country, for example MDGs.

However, the traditional health sector is not a “lawless place” and it is an equally important component of the HIS. Informal institutions provide increased participation and space for flexibility, allowing for more emergent changes (Piotti, Chilundo et al. 2006). Diffusion of innovation is slow when the institutional environment is contentious (Tolbert and Zucker 1999) as is the case with the traditional health sector. Therefore, more attention to the traditional health sector is needed to ensure steady and long-lasting HIS diffusion across the health sector. The problem is that informalism is understood as a metaphor for institutional weakness (Stark 1989) and often belittled as undesirable (Portes and Sassen-Koob 1987). The reality is that formal and informal institutions complement each other. To have a clear understanding of the institutional inter-play, it is important to have prior understanding of the communication practices in the context. As such, an epistemology which assumes “the social construction of knowledge and reality” is needed (Walsham 1995). HIS also has significant implications for the governance of a health sector and addressing health service delivery problems (Braa, Monteiro et al. 2004).

3.1.4 Governance, Policy, Politics, and Health Sector Interrelationship

Governance is a process of decision making, by which decisions are implemented (or not) involving both formal and informal actors (UNESCAP 2011). Governance is a key determinant and is increasingly regarded as a salient theme (WHO 2008b), influencing the performance of health systems. Despite its centrality in shaping health systems performance, governance remains not a well-understood concept (Siddiqi, Masud et al. 2009) and poorly practiced in the health sectors of many developing countries (Braa, Monteiro et al. 2004). An important point that is often misunderstood by both governments and citizens is the fact that governance is not about governments alone. While the government establishes the institutional framework and provides policy directions for the health sector, institutions and linkages that affect interactions among citizens, government officials, and health service providers contribute significantly to health governance success (Brinkerhoff 2009). Actions and means which a society adopts to promote and protect the health of its population is what health systems governance is all about (Dodgson, Lee et al. 2002; Siddiqi, Masud et al. 2009). Governance in the health sector is guaranteed by constitutions through nations and international treaties (Pappas, Ghaffar et al. 2009), and play out in the domains of both policy and politics (Hajer and Wagenaar 2003; Leftwich 2008). Inter-relationships must exist in the development process of governance, policy and politics.

Good governance leads to good policies and vice versa, whilst policy development also depends on political complexities of the government structure (Torjman 2005). An excellent policy could end up being very different from its intent if not properly implemented. Politics is often a reason for this, defined as a process by which groups of people make collective decisions, consisting of social relations involving authority or power (Sartori 1973). Related literature also reaffirms that there are political dimensions in the health sector (Reich 1995; Navarro, Muntaner et al. 2006; Borrell, Espelt et al. 2007). In most countries and at international level, the political dimensions within a health sector tends to be overshadowed by economic issues (Reich 1995). In the Malawi health sector for example, the way resources are allocated is politically determined (Lwanda 2002). Hence, "Politics affects the origin, the formulation, and the implementation of public policy, especially when significant changes are involved" (Reich 1995) p.48.

Policy on the other hand is defined as a concept, or a guiding principle used to set direction in an organization by guiding and influencing decisions (Torjman 2005). From this definition, it is clear that policy and governance are inevitably political (Reich 1995) and influence decisions. Travis, Bennett et al. (2004) identify the quality of governance, policy environment, and political instability as the key to external and environmental constraints within the health sector, which is believed to present greater barriers than resource constraints. Despite this, health sector reforms are mostly treated as technical and economic processes, ignoring the political dimensions (Reich 1995). On these lines, Shiffman (2007) asserts that the process of attaining public health goals should be treated as both a medical and political challenge in developing countries. Health sector, like other organizations, cannot avoid having policies and rules because they determine how work is done, the behavior of people (OQPF 1990), which shape the course and pace of change (Milio 1988). What matters most is not what should be done; rather how to do it and identification and correction of the root cause of why things go wrong (Reich 1995).

Most developing countries often wrongly focus their health policies on the content of the reform while ignoring the processes, and the context within which the policy is developed (Walt and Gilson 1994). Milio (1988) stresses that such policies risk failing. In some instances; the health policies may not be appropriate for both the modern and traditional health sectors. Although traditional health sector may be sidelined by a policy, people still utilise those services. Considering that "political rationality looks only for feasible solutions" and that under pressure, decision makers discard information … and simplify a problem to the point where it becomes manageable (Keen 1981) p.2); the data generated within the traditional sector risks being sidelined as well. Marginalised groups cannot be included in a set of structured social relationships responsible for excluding them (Labonte 2004). In the same vein, the data cannot be included in HIS if the traditional health sector responsible for generating that data is sidelined. On the other hand, modern states are being reshaped by practices of multiple forces (such as systems, networks, communities, groupings, countries, institutions, individuals) acting simultaneously, for the common good (Cf.(Reich 2002): p1669).

3.2 Communities of Practice (CoPs)

CoP as a social theory was described in 1991 by Lave and Wenger (1991). CoPs require three components: the domain, community, and practice. In a CoP, individuals with common interests and concerns interact on a daily basis, they form their own practices and experiences as they utilise their ideas. While a community is defined as participants who share similar objectives, bounded by some rules and procedures (Igira 2008), practice is what the community does in "a historical and social context" that gives structure and brings about meaning of members' daily experiences (Wenger 1998) p.47. As individuals interact and engage in actions within CoPs, learning takes place and knowledge is cultivated. Learning can be described as a situated social phenomenon among individuals and the environment. In

CoPs, learning affects both the individual and community - individuals contribute to their community practices by bringing in improvements to their practices as new insights are transformed into knowledge (Wenger 1998; Brown and Duguid 2001).

The interactions take place through participation in groups which in CoPs are referred to as communities. To complement participation, ideas, experiences, abstractions and other intangibles are represented as objects giving a form of 'thingness' through a process of reification, representing what is being shared within the community. Since those participating have common interests and concerns, sustained interactions give rise to identities and boundaries , creating a practice-related social network with collective action (Lave and Wenger 1991; Wenger 1998; Brown and Duguid 2001; Wenger, McDermott et al. 2002; Puri 2003; Wasko and Faraj 2005; Roberts 2006) The duality of participation and reification allows for both formal and informal processes to be represented, towards a better understanding of the 'context' where (Walsham 1993; Avgerou 2007).

Participation in one CoP extends to other CoPs through connections across boundaries where meanings are negotiated and where learning takes place. To avoid breaking practices, participants create social sanctions which they use to enforce their commitment to the community. (Wenger 1998; Wasko and Faraj 2005). When developing IS within a particular domain, the connections across CoP boundaries are crucial. In case of the health domain, the connections help to enhance knowledge and data sharing across sectors and hierarchical administrative levels.

Although ICTs play a vital role in IS development, it does not guarantee knowledge and data sharing, which depend on various other practices such as local improvisations, work and communication practices, and tensions that surround the collection and analysis of data (Orlikowski 1996; Sahay and Avgerou 2002; Mosse and Sahay 2003). CoPs therefore can potentially provide a more nuanced approach to analysing these practices and the way knowledge and data are generated and shared across different communities. I draw upon this understanding to analyse issues around data quality which spans multiple communities.

Using the CoP as a lens of analysis, gives different perceptions from different communities (such as TBAs, health workers, village communities) within the health domain which can be used in a complementary manner. Being an environment with a dualism of modern and traditional health services, formal and informal practices; different aspects of learning takes place. Being everywhere and forming part of our daily lives, CoPs provide appropriate concepts to analyse the collective learning and sharing across the two sectors. Individuals may utilise one health sector or the other. Whichever sector they choose, CoPs exist. With connections across CoP boundaries, the histories created in one CoP are shared. A CoP therefore has its own internal practices and dynamics, at the same time, have relations with other CoPs (Wenger 1998). Similarly, histories created in (and practices of) one health sector or administrative level cannot be considered in isolation from other sectors, levels, and the broader context.

Three dimensional relationships exist between practice and community: through mutual engagement, joint enterprise, or a shared repertoire (Wenger 1998). As CoP members engage in activities together, negotiating meanings to solve common problems, homogeneity is avoided through their mutual engagement. Diversity is inescapable within a CoP as individuals of different experiences, age, gender, skills or professional levels interact. What matters is that individual inputs influence and shape the way their common concerns are solved. For example, a common concern for the maternal and child health program in the health domain is to reduce maternal and child deaths. Solutions offered by health professions may not be the same as those offered by mothers. Solutions offered by TBAs may not be the same as those offered by male members. Through mutual engagement, joint enterprise is achieved as individual know-hows and complementary contributions from others ensure that consensus and mutual accountability takes precedence.

3.2.1 Knowledge Cultivation in CoPs

Knowledge is the capacity to act. CoPs seek to accumulate and manage knowledge in a systematic manner. When members interact, patterns, trajectories, and new meanings are formed, adding to the existing stock of knowledge. The connections across CoP boundaries allow for the knowledge to flow. Knowledge flows are best understood by examining work practices and their outcomes. Where individuals have a common practice, knowledge readily flows, and an enabling environment that supports its exchange is created (Brown and Duguid 2001; Wenger, McDermott et al. 2002; Wasko and Faraj 2005).

Often, we cannot always express what we know. Some skills are passed on through observation and experience. Participants of a CoP have an opportunity to observe what others are doing. As such, CoPs provide a platform where learning can take place and knowledge is cultivated also by observing the way others do things. Once it becomes visible, the way things are done in the community which one belongs to, the knowledge generated can be appreciated. It follows that an understanding of the local knowledge and practices help identify what is needed, and how the local knowledge can best be utilised. Local knowledge needs to be cultivated, nurtured, and utilized appropriately over time. Much as research needs to be tailored to people's local knowledge and practices, and based on their needs, this knowledge is often ignored. For example, knowledge that people affected by disasters display in disaster preparedness and mitigation is largely ignored by both International Aid Agencies and their national governments (Dekens 2007).

One limitation is that knowledge cultivation focuses more on explicit, formally coded type of knowledge although in our daily activities both explicit and tacit knowledge is utilised. The local knowledge is both explicit and tacit in nature, and often it is the latter which is emphasized. As Tee and Karney (2010) have written:

> Something that is "explicit" means that it is simply stated in words or illustrations. However, words or illustration always have to be interpreted, and interpreting always relies on a tacit understanding that has not been or cannot be stated (Tee and Karney, 2010; After Stahl, 2003).

There are three schools of thought through which tacit knowledge is viewed. One school of thought initiated by Polanyi (1967) is that tacit knowledge cannot be fully externalized to explicit knowledge, nor fully captured to be transferred to somebody else as it involves a series of social interactions and personal reflections (Polanyi 1967; Tsoukas 2003). A second school of thought is that although it is a difficult process, tacit knowledge can be captured and converted to explicit knowledge (Nonaka and Takeuchi 1995; Nonaka, Toyama et al. 2000; Tee and Karney 2010). A third school of thought looks at knowledge as a continuum that exists on a spectrum where tacit knowledge interacts with explicit knowledge (Leonard and Sensiper 1998). Leonard and Sensiper (1998) argue that at one extreme, the spectrum is almost completely tacit and at the other explicit.

From my point of view, local knowledge is conceptualized as having both tacit and explicit nature, which complements each other in carrying out practices, and utilization of both is essential for HIS. Classifying knowledge as a dichotomy of explicit and tacit is not appropriate as both aspects exist and contribute to the practices in communities (Wenger 1998). Hildreth and Kimble (2002) give Orr's 'war stories' as an example that demonstrates how tacit and explicit knowledge operate together, not as a dichotomy. They explain how the utterance Orr's story itself is an externalisation of the teller's inner thoughts, although the knowledge held by the teller cannot be wholly externalised and passed as information. Within the CoPs, explicit and tacit knowledge is cultivated and both are utilised to generate the data that is utilised in HIS.

3.2.2 Participation in CoP within the Malawi Health Sector

Participation connects those engaged in common practices, helping to form identity and ownership of negotiated. Participation as a process not only connects, but it also involves doing, talking, thinking, feeling, belonging, and sharing members' concerns, passions, and problems. Members develop a unique perspective on their concerns, and over time, develop a body of common knowledge, diverse and complex practices and approaches (Wenger 1998; Wenger, McDermott et al. 2002).

The participation and practices converge through mixtures of power and dependence, expertise and helplessness, success and failure (Wenger 1998). For example, one of the CoPs identified within the health sector - *village committee-* forms a group of village members from diverse backgrounds although their level of power and expertise differs. The group comprise of chiefs (village head) with a significant power base within their communities, TBAs with expertise in delivering babies, and other village members –young, old, male, female, literate, and illiterate. Yet their practices are connected by the mutual engagement and shared through a common goal and passion of promoting safe-motherhood. Thus, the grouping forms an identity of advocates of safe-motherhood. Furthermore, as a CoP, the *village committe*e also encounters failures; beliefs of some pregnant women (cultural or religious) do not allow them to go to hospitals. Although this group is equally supposed to pay *chindapusa* (a penalty) for failing to have their babies delivered at a health facility, they refuse to pay, arguing its part of their beliefs. The *village committe*e does not have mechanisms to ensure that *chindapusa* is paid by this group. This creates tension between the *village committe*e and those who would have already paid *chindapusa* and may cause the group of defaulters to grow. This may be considered as failure.

In the health domain, sharing that starts at a local level extends to global level. The fact that histories created at community level within the Malawi health sector can be transferred to health facility level, then to district, national, and international level in a form of MDGs indicators performance reflects this global-local reality. For example, the data on births generated at local community level feeds into HIS at national level; the national figures are then shared to the global community. This gives evidence that participation at local level contributes to the global level through sharing across CoPs. However, “in the context of constellation of practices, the local and the global are not different historical moments” (Wenger 1998) p.131, they coexist and shape each other. Even at global level, a practice still has a locality of engagement (Wenger 1998). Much as the global MDGs shape what is happening at country level, a process of recording births data within a local community in one of the countries also shape the MDGs. For instance, Wenger (1998) illustrates how people may see what happens at the UN headquarters as global, yet the day-to-day work in an office at the UN headquarters is still local.

Sharing histories entails crossing CoP boundaries (Wenger 1998), requiring connectors such as *boundary objects*, *boundary interactions*, *boundary spanners*, and *knowledge brokers*. These are discussed.

3.2.3 Connectors between CoPs

Boundary connectors allow interactions and sharing across CoPs, and sharing of their histories. *Boundary objects*, *boundary interactions*, and *brokers* also referred to as *boundary spanners* are forms of connections; they combine *participation* and *reification* (Wenger 1998). The connectors can be concrete or abstract (Star and Griesemer 1989); what matters is that they facilitate knowledge sharing across different social worlds, keeping something together even when there is no common ground (Wenger 1998).

What is passed on through the connectors across boundaries needs to be effectively managed, considering the fact that the boundaries hoard both domain-specific and common knowledge. It is the degrees of disagreement that matters. When capacity and ability to manage common knowledge are lacking, the knowledge may end up being misrepresented across boundaries (Carlile 2004). There is the need to match the knowledge created in the traditional sector with that of the modern sector because the socio/cultural realm in which the knowledge is created is different.

What is reified that is passed on as boundary objects. In the health sector, the reification is mostly in form of reports and concepts. Forms, reports, and terms serve to coordinate the knowledge and data generated in different CoPs in the different administrative levels. The terms are crucial in the health domain, particularly for referral cases; for example, the term *primagravida* is used for a woman giving birth for the first time. Whilst the forms are used to capture data, reports are appropriate for transferring the aggregated and analysed data. Boundary objects may take different forms and have different characteristics which include: modularity, abstraction, accommodation, and standardization. One boundary object such as a report can contain collection of details with different perspectives relevant to different health programs, In that case, the report is said to be modular. *Modularity* is where different receivers can attend to different portions of the information contained in a boundary object. Another characteristic commonly possessed by boundary objects is abstraction. When specific features are abstracted and a common identity maintained across CoPs, there is *abstraction*. *Accommodation* "lends itself to various activities" whereas *standardization* is a situation where a prespecified form which allows different constituencies to deal with the boundary object locally is set (Star 1989; Wenger 1998).

As we live in our societies and work in our organisations, we interact with others. Some of the interaction takes place within CoPs where individuals belong to and sometimes, the interaction acts as a boundary spanning activity. When interaction spans boundaries, it exposes the beliefs, practices, perspectives and politics of participation of one CoP to the other CoPs (Wenger 1998). Interaction that connects CoPs varies; i) members of one CoP being immersed in the activities of another CoP, or ii) members participating in practices that develop between two CoPs Cf. (Wenger 1998) p111-116.

Interactions at points of CoPs intersection need to be nurtured because not all CoPs produce boundary objects and in the absence of boundary objects, the interactions facilitate sharing of knowledge and data. The greater the degree of face-to-face interaction, the better (Wenger 1998; Dobbins, Robeson et al. 2009).

As mentioned in section 1.6, another way of interacting is through knowledge brokers, also known as boundary spanners. Whilst boundary objects as connectors to other practices were mostly through reification; interaction and brokering are more of participation. Brokering entails that one member belongs to two (or more) CoPs. As the member participates in the different CoPs, they transfer, exchange, coordinate, negotiate, translate, align elements of one CoP into another and mediate between different perspectives (Wenger 1998). With the task of negotiating and mediating, brokers (or spanners) need to be abreast with the way issues are handled and expressed in both CoPs.

Knowledge brokering bridges the *know-do* gap for health services and is effective in improving the quality of decision making because what is transferred is translated by someone who understands the practices of both CoPs. Therefore, knowledge brokers needs to be good communicators, trustworthy, innovative, and one who understands the CoPs cultures (Lomas 2007). Two CoPs may have a common concern but their way of doing things may be different. For example, a *village committee* and a *health facility* CoP discussed in this thesis. The former belongs to the traditional health sector whereas the later belongs to the modern health sector, yet the data generated in the two CoPs needs sharing. This is like crossing different worlds. The boundary crossing is therefore considered to be hazardous. In some cases there is a high degree of discord across worlds and boundary crossing becomes virtually impossible.

> "At boundaries, things can fall through the cracks – overlooked or devalued because they are not part of any established regime of accountability. … There can be places of marginality where separation is maintained in spite of some mutual engagement. … Discontinuities can be as productive as continuities for the negotiation of meaning. Boundaries … release tension; they create new mountains; they shake existing structures. … They are where the unexpected can be expected, where innovative or unorthodox solutions are found, where serendipity is likely, and where old ideas find new life and new ideas propagate." (Wenger, 1998: p. 254-255).

3.2.4 Value, and the Downside of CoPs

Why organisations form CoPs is not always clear. The CoPs sometimes may have fragmented boundaries rather than forming a broader, coherent configuration. Bearing in mind that the notion of boundary does not reflect organisational politics they still considered as learning opportunities, and both assets and liabilities that reflect and shape organisational learning. "The richness of boundary processes therefore is a sign of learning. "Such an evolving constellation of practices defines a landscape of continuities and discontinuities that dynamically shape an organisation's ability to negotiate meaning" (Wenger 1998) p.256.

For example, within the traditional health sector, CoPs are organic, with a lot of learning, non-formal, generating expertise, experiential, and more practice based. They create their own continuities and discontinuities created by their boundary with the modern health sector; in the process they form both assets and liabilities. I therefore argue that despite the limitations (Wenger, McDermott et al. 2002; Roberts 2006); the CoP approach remains well suited for the understanding of the creation and transfer of both knowledge and data through practice. It focuses on the social interactive dimensions of situated learning common at the community level in the health sector. This is the level of focus in this thesis, and where arguably most data is “lost”.

Much as there are other social theories such as the social network theory (Wasserman and Faust 1994; Scott 2000), and network of practice (Brown and Duguid 2001; Wasko and Faraj 2005), I found CoP to be the most appropriate for my analysis. Social network theory focuses more on relationships, the social inter-relationships and implications of these relationships (Wasserman and Faust 1994). Whereas the CoP concentrates on knowledge cultivation within communities with sharing as a common concern (Wenger, McDermott et al. 2002). It also has the potential of improving the ability of those “outside the network” (marginalized) to participate.

Within the CoPs, participation enhances the social activities supporting learning, and where there is learning, knowledge is created (Tuomi 1999). However, Tuomi (1999) articulates a point, crucial to this thesis, - a “reversed hierarchy of knowledge” - that links knowledge generation to data generation in CoPs. He argues that when the conventional hierarchy of data-information-knowledge is turned around, the knowledge creates information, and “data emerges as a by-product of cognitive artifacts that assume the existence of socially shared practice” (Tuomi 1999) p.19. If knowledge creates information and data emerges, then CoPs not only cultivates knowledge, but they also cultivate data.

Tuomi emphasize that data does not exist without external reality that can guide its structure. Tuomi (1999) illustrates this using a prototypical example from the domain of thermo physics, showing the contextual requirements for measurement of empirical data. The illustration demonstrates how important aspects of knowledge are required to come up with a thermometer as the measuring device for collecting data on temperature. Data, exists only after a pre-judgment is made; after a thermometer is created with the possibility to observe temperature as data. Tuomi further explains how several prominent philosophers of knowledge, like Bergson, James, Husserl, Heidegger, and Mead [C.f. (Tuomi 1999) p.5-10] “share the fundamental insight that the world as an object of human knowing exists only as an interpreted world that is completely infused with meaning”. The meaning is provided by the knowledge.

Tuomi's (1999) "reversed hierarchy of knowledge" helps me to articulate my argument that both data and knowledge are created within CoPs across different sectors and administrative levels. However, most health sectors have 'fragmented IS' influenced by different factors which include international policies that tend to favor vertical rather than horizontal programs (Braa, Monteiro et al. 2004; Mosse and Sahay 2005; Kanjo, Moyo et al. 2009). Integration has therefore been widely proposed as a solution (Sahay, Monteiro et al. 2009; Nyella 2011; Sæbø, Kossi et al. 2011) to this fragmentation problem. For HIS integration to be effective, there is need to link data generated in different health sectors, and administrative levels. CoP as a theory allows for understanding sharing. Tuomi's "reversed hierarchy of knowledge" provides evidence that both knowledge and data are generated and shared within CoPs (Tuomi 1999). The sharing across CoP boundaries therefore help enhance integration of data across sectors and administrative levels into HIS.

In the health domain, it is data that feeds into the HIS. The advantage of CoP is that it helps to articulate both the social and negotiated character of both explicit and tacit knowledge, allowing members to share both *what they are able to say* and *what they are able to do* (Wenger 1998). This allows for strong personal relationships, good interacting mechanisms, and a common sense of identity (Wenger, McDermott et al. 2002) which facilitates informal sharing of knowledge (Huysman and Wulf 2005). Knowledge therefore resides in the skills, understanding, and relationships of CoP members.

Sharing of knowledge, data and practices across CoPs and organizations, allows for them to feel success both locally and globally. A health sector that shares knowledge and data can succeed in meeting MDG health-related goals both at a local level as well as global level. CoPs create local depth which creates boundaries, yet at the same time they develop ways of maintaining global connections, creating new learning opportunities. Another important strength of CoP is that it enhances governance; members do have "clear roles and expectations" as they participate (Serrat 2010).

In this thesis, CoP was chosen as a theory for analysis because of the link between learning and knowledge on one hand; and the link between knowledge and data on the other. The relation between learning and knowledge has been discussed and explained in the CoP context (Lave and Wenger 1991; Wenger 1998; Roberts 2006). However, the link between knowledge and data has been hardly discussed in the CoP discourses. The generally accepted view is that of data as a prerequisite for information, and information as a prerequisite for knowledge (Davenport 1997). This view is however contested by Tuomi (1999) who argue that this conventional view on the traditional hierarchy of data, information, and knowledge requires rethinking, and needs to be reconsidered (Tuomi 1999). Using Tuomi's argument of "reversed hierarchy of knowledge", I argue that one of the values of CoP is the ability to enhance data generation through the knowledge created.

In addition, CoPs create values to both its members and organisations, these include: i) short and long-term values where CoP members can benefit from the information and knowledge generated instead of searching for such information elsewhere; ii) tangible and intangible values like sense of trust, ability to innovate, sense of belonging, and identity; and iii) strategy implementing and strategy making value where new strategies can be developed and/or existing ones implemented (Wenger, McDermott et al. 2002).

Although the CoP approach has been used to analyse and facilitate knowledge transfer in a number of organisations, there are various limitations. Whilst the value of CoP promise a lot in terms of cultivating and sharing of practices and knowledge for learning; it is deemed that with time, members may develop a crust that avoid any new insights developed outside their CoPs. Others may believe that nothing good can come from outside their CoP. "Pride of ownership can induce a fall as legitimacy of community's hold on its domain increases, arrogance of undermining perspectives from other communities sets in (Wenger, McDermott et al. 2002) p.141.This results in a CoP can becoming stale and be "an ideal structure for avoiding learning" (Roberts 2006).

Earlier, boundaries have been argued as being locus of production of new knowledge; the same boundaries can also be "places of marginality where separation is maintained inspite of some mutual engagement" (Wenger 1998) p. 254. The health sector is one such domain where separation between the traditional and modern health sector is maintained. Despite the two co-existing, mechanisms for collecting and sharing knowledge and data generated from the traditional health sector lag behind.

Power issues may also arise within and in the context where a CoP is embedded since CoPs are built and sustained through interactions between their members (Roberts 2006). Bureaucratic tendencies (Mosse 2000; Puri, Byrne et al. 2004; Byrne and Sahay 2007) evident within the context where CoPs exist pose some challenges during participation as it widens the power gap. In some cases, CoP members vest all the power in one member and do not share responsibilities. Further, like most situations that involve interpersonal engagement, tensions, misery, disagreements, rebellion, competition and conflicts also exist in CoPs (Wenger 1998). That not withstanding, when properly handled, rebellion reveals a greater commitment than does passive conformity (Wenger 1998). A good example is a situation where within a community of health professionals in the Malawi health sector, others support the use of head-counted data as denominator value against the officially recommended census figures.

Another downside is that communities may be marginalized if they fail to assert their legitimacy and importance to other communities. If a community becomes too large, it risks being disconnected as members' participation can be superficial (Wenger, McDermott et al. 2002). Another critique is that a CoP's interests may not always be aligned with organisation's interests (Kimble and Hildreth 2004).

Despite the limitations, Roberts (2006) conclude that developing a clear understanding of the socio-cultural environment, a detailed classification of types of CoPs, and how they interact with formal structure of an organisation is a good recipe for their success.

3.3 Feminist Discourses

Feminist discourses dates back from late 1700s. It gives attention to the social and cultural context. It is paramount one of the fundamental ways of classifying our social existence is through gender. One has to know whether a baby when it is born, is a boy or girl. Central to feminist discourses is that girls and women are mostly marginalised. The feminist epistemology is paramount because it allows marginalised groups to develop their own approaches towards emancipation through their own knowledge (Haraway 1991; Adam 2001).

Feminist discourse is crucial for this research because the area of focus (maternal and child) mostly concerns women. This is not to rule out male involvement in the process, but to emphasize the fact that it is a woman who carries the pregnancy, yet when it comes to decisions about the pregnancy, men may have an upper hand. Births attendants in the traditional health sector are all women (the TBAs), in the modern health sector too care givers are mostly women (female nurses and midwives), and those who take care of babies on a daily basis are mostly women. The research also concerns changes in the roles of the TBAs and chiefs (mostly men). In the health domain, there is need to have estimates of the number of women expected to become pregnant from the population figures. As articulated by several scholars, a critical analysis of the diversity that exists in the female gender can highlight the power relations that exist within the female category. The social-construction of women as a lesser gender (as technophobes disinterested with technology or as the inferior gender), reinforces inequality and deters contributions from women within communities (Trauth, Huang et al. 2006; Trauth and Quesenberry 2006).

So far, there has been little research addressing gender as a research variable in IS. I therefore reflect on how the feminist discourses may be important in analysing factors affecting HIS data quality. As Adam (2001) suggests, feminist discourses are a fruitful starting place to analyze certain gender concepts which have been imported into IS that question the validity of our knowledge of the world. He further argues that these gender issues can only achieve results if the fine structure of emancipation is better understood (Adam 2001).

The Malawi health sector has a number of problematic issues which contribute to data being missed; these include i) environmental factors such as governance, policy, and politics as discussed in the previous chapter. These factors, constrain the way data is collected, and ii) the availability of modern and traditional health sector and the fact that reforms (i.e. data collection mechanisms, information systems) within the health sector are asymmetric to the modern sector. To understand how these problematic issues interplay with the health sector, it is important to first understand how historical factors such as colonisation, religion, patriarchal society, donors' role in determining health system priorities, top-down and centralized government shape the practices within the health sector. The feminist epistemology therefore complements the CoP concepts to analyse some of these issues. It helps understand the particularities of colonisation and gender, the practices in the health sector environment, and how they directly or indirectly impact the way data is collected (or missed). Feminist discourses in this thesis is explained and analysed bearing in mind that the study took place in a context that was colonised up until 1964, and is a patriarchal dominated society.

Like other colonised societies, Malawi shares an intimate experience of "the politics of oppression and repression" (Nacer 2010). As citizens of a nation, the colonialists were the oppressors. On the other hand, the social existence of these citizens brings about another level of oppression, where women are the marginalised lot. This opinion echoes Donna Haraway (1991) who articulates that gender, like race and class consciousness is forced on us by the terrible historical experience of the contradictory social realities of patriarchy and colonialism. According to Haraway (1991), modern feminism face social barriers fragmenting women and turning them against each other, and not allowing them to have a "finite point of view" (Haraway 1988). The history and concerns of feminist theory have therefore paralleled developments in post-colonial theory and they both seek to reinstate the marginalised in the face of the dominant.

Feminist discourses argue that the silencing of women by men is comparable to the representation of the colonised that helps uphold colonialists dominance leading to a situation where women end up being 'double colonised' i.e. being women in formerly colonized societies, they "were doubly colonised by both imperial and patriarchal ideologies"(Ashcroft, Griffiths et al. 1998):p. 269. With the 'double colonisation' notion, women were treated as objects and positioned on the boundary between human and animal. The African woman was subject to different forms of marginalisation; were voiceless, and depersonalized into symbols, mythical figures or similar abstractions (Nacer 2010).

3.3.1 Marginalisation and Health Sector

Scholars like (Osborne 1995) and (Barney 2007) have noted that the Australian Indigenous Torres Strait Islander women were marginalised, enduring isolation and poverty. However, they both emphasise that letting the marginalised women speak out would make other dominant societies to be better informed. Both Osborne (1995) and Barney (2007) acknowledge that Torres Strait Islander women's skills and knowledge of medicine preparation, among other things, was strong although historically, the knowledge was "devalued and suppressed". For the Torres Strait Islander women, contemporary music provided them with a powerful voice to reach out to others.

In this thesis, I support Osborne's (1995) and Barney's (2007) argument of the marginalised voice making the dominant better informed. Despite the fact that 52% of the Malawi population (NSO-MPHC 2008) are female, the women in Malawi, like the Torres Strait Islander women, remain marginalised. Of the 63% who live in poverty, women are disproportionately represented among the poor and disadvantaged in terms of access to health (Ngwira, Kamchedzera et al. 2003). Women marginalisation is a culturally embedded notion, particularly in developing countries. Despite ratifying Convention on the Elimination of All Forms of Discrimination Against Women (CEDAW) in 1987, in Malawi, a girl still bears more burdens than a boy in a sense that – they have to do house chores, fetch water, prepare food before going to school. When a member of the family is sick, it is usually the girls and women who take care of the sick. Yet when it comes to decision making, it is the men who decide. In some cases, men have to decide the place of birth when the wife is pregnant (Seljeskog, Sundby et al. 2006). The marginalised women therefore include the TBAs and the pregnant women. To be a woman and to be in the rural poor communities means being on the receiving end of triple marginalisation; first as women, then as rural and poor. The fact that most women who are poor also reside in rural communities brings in another discourse of traditionality and modernity.

3.3.2 Modernity and Traditionality: Gender Roles

Modernity and traditionality in this thesis is synonymous to modern health sector and TBAs in the traditional health sectors. Modernity is the advancement through progress in a dynamic inversion (Beck 1992). One school of thought is that the dualism of tradition and modern implies that systems undergoing modernization would eventually displace traditional systems. Whereas another school of thought is that the two will continue co-existing since informal (traditional) institutions have been extraordinarily resilient in virtually all cultural, social and political settings (North 1994; Nee and Ingram 1998; Posner 2000). The position in this thesis is that modernity and traditionality continue to co-exist in the health domain. This is evident with the medical dualism where patients who get services from the modern health sector also get services from the traditional sector and vice versa.

Feminist discourses apply to this co-existence because the ways in which gender roles are perpetuated in the two sectors are different. Traditionality is mostly in the rural areas where a large number of individuals (particularly women) are less educated, but have strong cultural beliefs. The cultural beliefs entail that a man, as head of house, is the one who decides where the wife is to deliver a baby. Such beliefs marginalise the women. For those who are less educated, their challenge may be affordability due to low income levels. Another group of women in the traditional health sector worth mentioning are the TBAs. This group also suffers marginalisation. The urban areas are associated with the modern health sector, although some health facilities exist in the rural areas. Most pregnant women in the urban areas have a voice; they are able to decide where to go to have their baby delivered. Traditionality is therefore associated with the marginalised and the less empowered. The roles of the male gender may be affected with modernity in cases where their wives are able to make their own decisions as to where to have their baby delivered, or how many children to have.

Modernity resulted in the introduction of health facilities owned by government, non-governmental organizations, missionaries, and privately owned. And is seen as the replacing of traditional health practices with modern scientific practices. Traditionality according to Salipante and Golden-Biddle (1995) is the willing reception of practices, beliefs, and values from the past, and their use in guiding current actions. These practices guide individuals, communities, and organizations through crisis and ensure their survival (Salipante and Golden-Biddle 1995). By disembbeding the socially accepted patterns and 'reembedding' a new order, society shifts from traditionality to modernity (Beck & Giddens, 1994). Although the world is changing, the informal health sector (traditionality) continues to provide survivability to communities. And in the context of this study, traditionality provides to 80% of the population.

3.3.3 Politics of Knowledge

Knowledge is no value unless put into practice (CheKhov, 1860-1904).

Politics of knowledge arise at different levels: local/global, community/national, and within organizations. The gender roles also contribute to the politics of knowledge. In some cases it is about which knowledge is superior to the other or whether the knowledge was generated by the marginalised role or not. In the health sector, tensions arise between local (indigenous) and global knowledge as international organizations develop different types of global generalized knowledge and tools to be used in member countries (Barrett, Fryatt et al. 2005). The global knowledge is legitimized and prioritized over local knowledge especially when there is donor interest. Just like the knowledge generated with male involvement is considered higher than knowledge generated without male involvement. On the other hand, national institutions develop local knowledge and in some cases, they use alternative indicators and measures in their information systems (Barrett, Fryatt et al. 2005). To tackle global health problems and poverty, a discourse of MDGs was constituted.

Within the health sector, knowledge needs to be translated across different levels, at the same time, the knowledge needs to be translated across countries towards the global goals. To achieve such translations, theories of how meanings are made are needed (Haraway 1988). This is clear evidence that politics of knowledge are also apparent in feminist discourses.

Whilst Brown and Duguid (2001) acknowledge the existence of “knowledge boundaries” between specialised domains; Haraway (1988) argues that all forms of knowledge claims and inside-outside boundaries in knowledge are theorised as power moves instead of being seen as moves towards truth. What matters is objectivity. Haraway presents two contradicting but complementing positions of objectivity; that despite having limited location, and situated knowledge, objectivity cannot be about a fixed vision especially when “what counts as an object is precisely what world history turns out to be about” (p.588). Following Haraway’s knowledge arguments, the knowledge created in the health sector CoPs is both locatable and situated, but not without distrust. The knowledge gained locally within the health sector is what later counts in the global goals.

Like the digital divide which both exists between and within countries, knowledge tensions may also arise within countries because variations in the context exist. For example, in the health sector, variations exist between the types of knowledge and practices used in modern and traditional health sectors. However, classification such as modern/traditional emerges as human and universal (Bowker and Star 1999), this allows for knowledge generated in one sector to be shared across the other sector.

There is need therefore to understand the deep-rooted assumptions in the context as some of the knowledge is deeply embedded and cultural-specific. In most cases, community knowledge is ignored yet it is important to transfer that knowledge to the scientists. The dualism of modern and tradition and the need to transfer knowledge across different levels of the health sector entails that knowledge generated in one sector should be shared to the other.

The knowledge tensions are also evident within organizations as there is no consensus on how to combine scientific and local knowledge (Abelson, Forest et al. 2003). Scientific knowledge is considered to be dominant (Laws 1994) and superior (Puri 2003) to the local knowledge leading to cases where use of indigenous knowledge is ignored (Dekens 2007; Mercer, Dominey-Howes et al. 2007) or undermined.

Despite the fact that the modern health sector has acute staff shortages (Hongoro and McPake, 2004) and disparities with respect to access to health systems (Gwatkin, Bhuiya et al. 2004), the idea of embracing the traditional providers which uses local knowledge and practices still meets some resistance. Although training TBAs in midwifery clearly raises the number of attended deliveries (Hongoro and McPake 2004), not all medical personnel favor it as they try to guard their niche. The issue of which knowledge is superior – indigenous or scientific – therefore, comes into play. In cases where some of the knowledge is not accepted, that knowledge ends up being background knowledge and discounted (Edwards 2010).

3.3.4 Knowledge-Practice Gap

The communities in the different health sectors emphasize different types of knowledge. Puri (2003) identified three domains of knowledge - *technical*, *scientific*, and *indigenous* - all of which are relevant to effective land management in India but working in tension with each other C.f. (Puri 2003) p.45-55. In this case, domains of knowledge - *scientific* and *indigenous* – will be discussed. Like the land management case (Puri 2003), scientific and indigenous knowledge in the Malawi health sector are both relevant and often in tension with each other. Scientific knowledge "concerns the application domain that derives from the scientific parameters" such as aggregated patients data; and is considered superior to indigenous knowledge (Puri 2003). Scientific knowledge is associated more with the modern health sector. Indigenous knowledge relates to, for example, how TBAs deliver babies. This knowledge is based on experience of members of the community and is held with the members (Puri 2003) and common within the traditional health sector. Both domains of knowledge are essential for the health sector therefore knowledge sharing across different communities is essential.

As practices change, knowledge created reflects the change in practices. Within the health sector for example, the knowledge created from the traditional practices needs to be reflected in the practices of the health sector. This may not always be the case and the gap however, should be closed in order to achieve quality. The knowledge-practice gaps within the health sector directly involve individuals in their practices; the gaps can be easily identified (Essani and Ali 2011). For example, Nyamtema (2010) concludes that under reporting, one of the symptoms for poor data quality is linked to lack of knowledge and practice of recording data consistently. However, Nyamtema only focuses on the one side of the health sector, the modern sector. In developing countries, such analysis needs to go beyond the modern health sector as there is great need to include data generated from the traditional health sector into HIS.

An example of the knowledge-practice gap within the health sector is how the modern healthcare system tends to underestimate the distinct functions of the traditional healthcare although it is understood to be linked to a country health care system (PAHO-WHO 1998).

3.4 The Weak Link

This section provides an additional concept of *weak link* (Goldratt 1997; Flink 2002). A weak link is the least dependable or most likely to break connection. Where two CoPs connect, the link needs to be stable and consistent, otherwise the link is weak. Much as CoPs provide an enabling environment for cultivating knowledge and data, this is not enough. An organisation's ability to coordinate, share and leverage the knowledge and data that is generated and flows into the different CoPs is what matters most (Brown and Duguid 2001; Wasko and Faraj 2005). In this thesis, a *link* is a boundary connection where two CoPs share practices, knowledge, or data through brokering, boundary objects or interactions. It is therefore necessary to ensure that these links are well established. To emphasise the significance of strong linkages across sectors, levels, and to ensure that the knowledge created in one CoP benefits other CoPs in the health sector, the *weak link* concept (Gilks and Spiegelhalter 1996; Goldratt 1997; Flink 2002) is used.

Identification of the *weak link* is crucial as this can help improve the situation. Once the weak link is identified, measures to strengthen that link can be deployed, and move on to find another weakest link. Within the Malawi health sector, significant amount of knowledge and data is generated in the traditional health sector, ironically, this is where there are more "marginalised groups" (Barney 2007) such as the TBAs (who are marginalised by the introduction of the SRHR policy). In addition, the knowledge generated in this sector, the indigenous knowledge, is considered as inferior (Dekens 2007).

Travis, Bennett et al. (2004) argue that small pilot studies cannot fully inform policy makers on how to scale-up nationwide because they do not cover all institutional arrangements needed. This supports the argument of why links must be strngthened so that data from the traditional health sector is included in the HIS to cater for all institutional arrangements. Similarly, Strauss (1993) has argued that performance of work in any organization whether formally or informally constituted is a collective act and includes interactions of all actors to get things done. Having weak links can compromise the data flow and quality. Travis, Bennett et al. (2004) also suggest that if health systems lack capabilities in key areas such as HIS, they may not respond adequately in removing health system constraints and impede the effectiveness of reform efforts. Having strong links to enhance effective data sharing is therefore crucial to HIS quality.

3.5 Proposed Theoretical Framework

This section consolidates the different conceptual ideas to form a theoretical framework for this thesis. Together, these concepts help to highlight how the knowledge and data are generated, and flow within the health sector, and how some data ends up being lost and never find its way into the HIS. Possible ways of curbing the problem and strengthening the links are proposed.

The inter-relatedness between CoP concepts and feminist discourses help to provide a nuanced understanding of the complex and deep-rooted nature of the factors that cause data to be missed. CoPs can provide a platform where feminist discourse offer discursive power, and opportunity to build communicative mechanisms that move away from the historical patriarchal and colonisation tendencies to context-responsive approaches. This will help to critique and counter the practices of exclusion which pregnant women suffer when it comes to decision making. Enhancing the women's discursive power within the CoPs will bring to light their suppressed knowledge (knowledge without male involvement) and provide a means of bridging feminist discourse and CoP within IS. Gender concepts in IS will therefore be analysed fruitfully (Adam 2001), women will have a "finite point of view" (Haraway 1991) as the marginalised will be reinstated, and the whole health sector will be better informed with knowledge from both men and women well balanced.

In addition, there is need to establish strong links that enhance the co-existence of modernity and traditionality within the health sector and move away from approaches which associate traditionality with the marginalised. Having strong links between CoPs within the health sector is crucial bearing in mind that the knowledge gained locally is what later counts in the global goals. Links therefore, have a visible impact on the inter-relatedness of the health sector administrative levels as a higher level depends on data generated at lower level. Figure 2 below illustrates how the three are intertwined. The feminist discourses exist in the social/cultural arena, whilst the weak link concept applies to the links between CoPs.

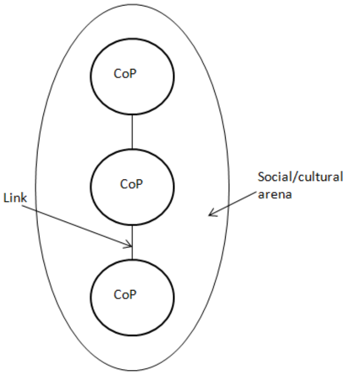

Figure 2 Illustration of the interrelatedness of the administrative level in the Social cultural Arena

CoPs have received increased attention in many fields including the health sector. Earlier, I have mentioned that there is need to have strong links across the different health sectors and administrative levels. It follows that having strong links between the CoPs within the health sector would enhance the linkages across sectors and administrative levels. This ensures that the knowledge and data generated finds its way into HIS.

To analyze and put into perspective why and how data quality in HIS is affected and consequences thereof, I portray the different instances of CoPs in the health sector as organised in a sequence like a chain. A chain is a set of associations occurring together as an alternating sequence of nodes and links and is depicted as conduit for communication. In a health sector, knowledge and data generated at a lower level influences what happens at a higher level; the data flows from the lower to higher level. The use of chain as metaphor is important in this research because a chain is as strong at its weakest link(Goldratt 1997). Therefore, a practical implication of weak link is that success of a system is significantly dependent on its weakest link. A weak link may cause relevant data to be missed, compromising HIS data quality.

Within the health sector, CoPs are like the nodes in a chain, and *boundary connections* are the links; data is missed if the link from one health sector level to the next is weak. Flow in this case is the sharing of practices, knowledge, and data from one CoP to another through *knowledge brokers* or *boundary objects* and *interactions*. Stability of flow of data across *CoPs* will depend on boundary *connection* where the link is intermittent. HIS can be efficient if all

CoPs in the health sector (both modern and traditional) share practices, knowledge, and data efficiently.

Like links in a chain, the most unreliable boundary *connection* between two CoPs can cause the whole HIS to fail. Identification of the *weak link* is crucial as this can help improve the situation. Once a weak link is identified, measures to strengthen that link can be deployed, and move on to find another weak link. CoPs are thus nodes for dissemination, interpretation, and use of information; "they are nodes for communication" (Wenger 1998) p.252. The use of *weak link* concept enhances the importance of the connections between CoPs. This is particularly useful in situations where the results of one CoP acts as input in the consecutive CoPs.

The underlying argument is that understanding the interplay between these concepts helps to analyze and visualise how knowledge and data are collected or missed, and shared across different levels of the health sector or lost before it gets into HIS, hence affecting data quality. CoP concepts such as *boundary objects, interactions,* and *knowledge brokers* help to understand how knowledge and data are generated and shared across health sector levels. Feminist discourses have tried to understand the way knowledge is constructed by calling into question the gender roles where mother and child health issues are concerned. The *weak link* is used to put emphasis on how different health sector levels are linked, and impact of losing data as it is shared from one level to the other and emphasizes the fact that for the system to remain viable, all the links need to be strong.

4 Research Approach

This chapter presents the process of data collection and analysis adopted for this research and how these relate to the theoretical concepts adopted. The chapter is organised in the following sub-sections: The first section provides the ontological, epistemological and methodological considerations adopted. The second section gives details of the research journey. This is followed by the data collection and analysis mechanisms used in sections 4 and 5 respectively. The chapter ends with personal reflections in the last section.

4.1 Background of the Research

A good understanding of the context is critical in IS development. As mentioned earlier, the Malawi health domain has two sectors, not dichotomous, with varying characteristics both in terms of service provided and the context. Like the situation in most developing countries, Malawi MoH introduced a Health Management Information System (HMIS) in 1999 which uses a free and open source software application called District Health Information System (DHIS) (Chaulagai, Moyo et al. 2005). The overall aim of HMIS is to collect, process, and report health information to different stakeholders. Paradoxically, although a large number of the population (more than 80%) utilises the traditional health sector, yet the HMIS mechanisms for collecting data are asymmetric and limited largely to the "non-traditional" sector, focusing where the modern health services are offered.

4.2 Epistemological and Methodological Perceptions

In IS research, different ontological and epistemological positions and methodologies have been used to understand the context and process of the research. These positions shape the approach to theory and methods utilised (Marsh and Furlong 2002). It is therefore important to understand these aspects as they guide the choice of approaches to adopt for a particular research. Ontology is described as the science of being. The question is whether there is a real world that exist independent of our knowledge of it (Marsh and Furlong 2002). Two ontological views exist: an objective and subjective view. Taking the subjective stance, ontology can be described as what we believe constitutes social reality, "claims about what exists, what it looks like, what units make it up and how these units interact with each other" (Blaikie 2000) p.8. Much as ontological position affect, it does not determine the epistemological position.

Epistemology concerns the assumptions about what constitutes knowledge, its sources and how it is obtained (Myers 1997). As with ontology, epistemology holds objective and subjective views. The multidisciplinary nature of IS research allows for different underlying research epistemologies- positivist, interpretive, and critical (Orlikowski and Baroudi 1991) - to inform different approaches – qualitative or quantitative (Miles and Huberman 1994) in IS. Methodology on the other hand, is how you go about finding out knowledge and carrying out research (Guba 1990; Wainwright 1997).

Ontological, epistemological, and methodological layers are related. The epistemological view adopted (positivist, interpretive, or critical) frame the interaction with what is being researched and depends on the ontological view adopted. If knowledge is seen as governed by the laws of nature, an objective approach is adopted and a subjective approach is adopted if knowledge is seen as something interpreted by individuals. This in turn affects the methodology. What reality is depends on whether you are seeing the world with a positivist, interpretive or critical view. I provide a brief description of each view below.

A positivist researcher sees reality as something 'out there', a law of nature that is objectively given, waiting to be found. An interpretivist researcher believes that knowledge is a social reality, and only comes to light through an individual’s interpretation. For an interpretive view, social world is considered to be subjective. Critical researcher knows that things exist ‘out there’ and that being human, researchers influence what is being measured. Critical view subscribe to the fact that reality is historically constituted (Myers and Avison 2002).

We all have inherent preferences and our ways of viewing the world that are likely to shape our research designs. This research is shaped by the ontological position that reality is socially constructed, with meanings constructed by humans as they engage with the world. The epistemological assumptions guide the choice of both methods and theories. In this research, CoP and feminist theories were used to aid the data collection and analysis processes. Based on the ontological and epistemological assumptions, an interpretive case study approach was adopted. Given the subjective nature of the interpretive approach (Walsham 1993; Walsham 1995), the empirical work is informed by qualitative methods (Miles and Huberman 1994). Understanding people’s practices as well as how they communicate, verbally and non-verbally is important (Easterby-Smith, Lyles et al. 2008) in this research.

The explanatory and analytical approaches and concepts used to make sense of reality also vary. For the purpose of this research, I assumed that while knowledge can be explicitly obtained from different forms of text or through formal learning, the most critical knowledge is what is obtained through our daily practices and interactions within communities where we belong. It was necessary therefore to adopt a research strategy that would provide an in-depth understanding of the phenomena within the health sector and allow the unfolding events to be directly observed over time. A case study was adopted as the research strategy.

Case study research is commonly used in IS research as it enables better understanding of the interactions between the system being developed and organizational context (Orlikowski and Baroudi 1991; Darke, Shanks et al. 1998). Case study as a method is independent of the research approaches and it can be positivist (Yin 2002), interpretive (Walsham 1993) or critical. Case study is well suited for IS because not only does it focus on in-depth understanding of the phenomenon, it also concentrates on developing an understanding of the context (Cavaye 1996). Another plus of case study is that it can encompass contradictory data from case to case, a thing that strengthens the results (Eisenhardt 1989).

The phenomena in this research aim to uncover the depth and breadth of the practices that leads to generation of MCH data in different environments. It also provided insights of the way data and local knowledge are created within communities and shared across the health sector into HIS, follow events and their consequences. The study is also interested in the factors that affect the way data flows from one level to the other. The focus is to understand how data is lost or missed along the way. Adopting an interpretivist position for the case study allows for methods that are compatible with the primary aim of this study.

An interpretive approach seeks to understand the complexity of human sense making in a constantly changing context and assumes that the knowledge of reality is gained through social constructions (Klein and Myers 1999; Nicholson and Sahay 2004). The social constructions include: use of language, attitudes, shared meanings, and documents among others. With the interpretive approach, situations do not just exist; they are created when a researcher enters into the world and is part of that reality and is involved in coming up with meaning.

An interpretive paradigm was best suited with the nature of my research problem. In exploring various views, interpretations, and meanings which people assign to events; deeper understanding and root causes of the problems unfold. This is analogous to optics where a prism is used to break up light into constituent spectral colors (the colors of the rainbow) and split the light into components with different polarizations (see figure 3). Similarly, in interpretative approach a single event (like light entering a prism) is split into different views and meanings based on individual interpretations (colors of the rainbow). As the light passing through a prism results in a spectrum, it remains light, but we are able to understand its different colors or components. In the same way, the interpretive paradigm enables understanding of a phenomenon and making sense of the social constructions that shape these interpretations.

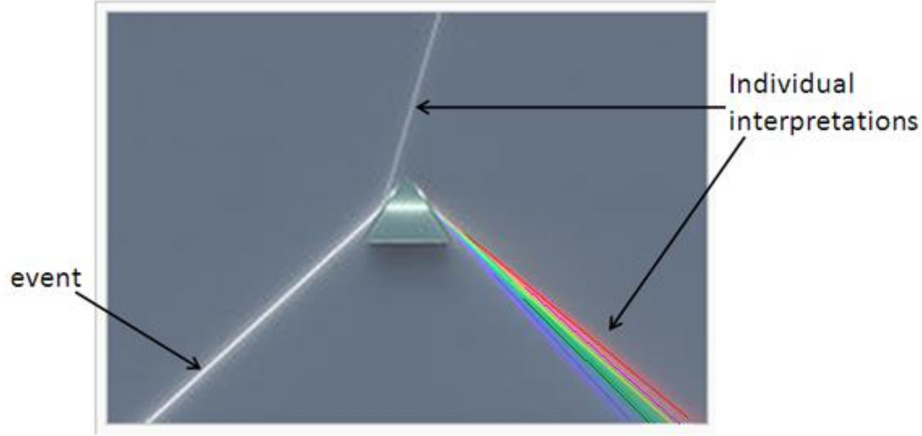

Figure 3 – Light splitting into a spectrum after passing through a prism

Whilst the underlying philosophical approach in my research was interpretative, qualitative methods were used for data collection. Qualitative research is well-grounded because it is conducted through intense and prolonged contact with the situation being studied. Researchers therefore are able to understand meanings, beliefs, experience and the social-cultural context and provide rich descriptions and explanations of processes in the local contexts (Miles and Huberman 1994; Myers 1997). The qualitative approach is open-ended, involved, and uses a small sample. Before, qualitative methods used to suffer from methods of analysis that were not well formulated (Miles 1979) leading to difficulties in generalization of findings.

However, this has now changed and the qualitative approach has different data analysis methods which give credible, generalized, and quality conclusions (Miles and Huberman 1994). Although the breadth of the sample is not that big, it is the depth that matters because a researcher can *keep asking until there is nothing new*. In addition, this allows researchers to go beyond snapshots of *what* or *how many* to a different level of understanding *how* and *why* things happen as they do and assess causality within the context Cf. (Miles and Huberman 1994) p.10).

The research journey (section 4.3) details the target population, how sample size was determined, how the sample was selected, how the associated process, questionnaire, etc. was designed, and how data was collected and analyzed. The research approach is made with modified settings of Eisenhardt (1989) roadmap as the guiding principle (see table 6 below). In this research, the modified process does not build new theory but creates new knowledge that extends conceptual ideas of the existing theory of CoP.

Table 6 Research Approach (Modified from Eisenhardt 1989).

Step	**Activity**	**Reason**
Getting started	Conceptualising Phenomena	Give an overall idea of the problem to be tackled
	Defining research question	Focuses efforts
	Theory or concepts to be used	Guides the data collection and analysis
Selecting case	Specific population/institutions	Constrains extraneous variation and sharpens external validity
	Theoretical, not random, sampling	Focuses efforts on theoretically useful cases – i.e., those that replicate or extend theory by filling conceptual categories
Crafting instruments and protocols	Multiple data collection methods	Strengthens existing theory by triangulation of evidence.
	Qualitative and quantitative data combined from both secondary and primary sources	Synergistic view of evidence
	Single investigator	Fosters consistency of perspectives and strengthens grounding
Entering the field	Overlap data collection and analysis, including field notes	Speeds analyses and reveals helpful adjustments to data collection
	Flexible and opportunistic data collection methods	Allows investigators to take advantage of emergent themes and unique case features
Analyzing	Within-case analysis	Gains familiarity with data and preliminary

data		theory extension
	Cross-case pattern search using divergent techniques	Forces investigators to look beyond initial impressions and see evidence through multiple lenses
Shaping findings	Iterative tabulation of evidence	Sharpens construct definition, validity, and measurability
	Replication, not sampling, logic across cases	Confirms, extends, and sharpens theory
	Search evidence for "why" behind relationships	Builds internal validity
Enfolding literature	Comparison with conflicting literature	Builds internal validity, raises theoretical level, and sharpens construct definitions
	Comparison with similar literature	Sharpens generalizability, improves construct definition, and raises theoretical level
Reaching closure	Theoretical extension when possible	Ends process when marginal improvement becomes small

4.3 The Research Journey

Getting Started

This study started with conceptualising phenomena to be studied followed by a research proposal, including definitions of research questions. "It is important to make the research domain as focused as possible, else the researcher can be overwhelmed with impertinent data and needless work". The proposal had to go through processes of approval prior to data collection. Initially, the data collection was planned for the period from January 2008 to December 2010. This was shifted by a period of six months whilst waiting for approvals on PhD proposal and ethics in May, 2008 and June 2008 respectively. Whilst waiting for approval, the process of literature review commenced to gain insight on which theories and concepts to use for the research.

The conceptualized phenomena were - a good number of pregnant women deliver babies out of health facilities. I therefore wanted to establish whether the data generated outside the health facilities finds its way into HIS, and if not, the impacts of missing data. This required a situation analysis of secondary data where pregnant women deliver babies, why, who assisted them, and what happened once a birth occurred – was it recorded, by whom, and how often. The empirical work would then seek to gain insights on whether "what one wants to learn determines how one should go about learning it" (Trauth 2001) p.5).

The phenomena necessitated exploration and analysis of the influence of traditional practices and other factors (external to the health sector) on the quality of data which is used in HIS. Consideration of where to conduct the study; who and what to study, how to collect empirical data, how to analyze the data, and how to summarize the data had to be done. The study involved interacting with people, getting to know more about their choices in life, as such there was also need for ethical consideration.

4.3.1 Research Setting

Selecting Case

The empirical setting for my research study was Malawi health sector, including its four levels: ministry, district, health facility, and community. At the ministry level, data was collected at the headquarters in the HMIS Unit; at district level data was collected at the district health offices (DHO) in one of the districts called Zomba. Data at health facility level was collected at three health centers (one urban and two rural) and the villages surrounding the health centers were used to represent both the community level. Figure 4 indicates the map of Malawi, with the district and catchment areas studied circled.

The main selection criterion for whom to interview and where within the health sector was to cover all the relevant stakeholders. The data was collected from community, health facility, district and MoH headquarters level. Zomba district was chosen because it has both urban and rural health facilities and communities and also includes all types of health facilities (i.e. government-owned, private-owned, Christian organizations owned, non-governmental organization owned, institution-owned, and traditional health providers). The rural settings also have areas considered to be semi-urban while others are remote rural areas. This provided a good opportunity to compare and contrast practices in the different settings. In addition, the researcher was familiar with the local language and this contributed to having key social skills which Walsham (2006) mentions to be a requirement in an interpretive research. Three health catchment areas were studied; one known as Ngwelero - representing the remote rural setting, Pirimiti representing a semi-urban area, and the other Matawale representing an urban setting.

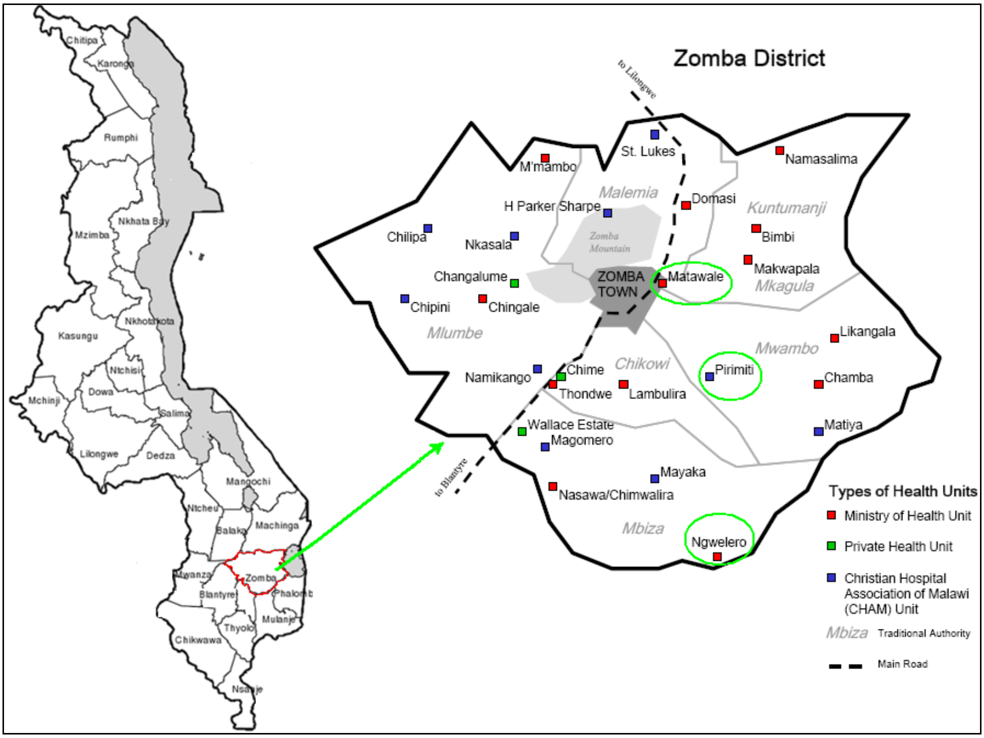

Figure 4 - Zomba District (the study site)

As mentioned earlier, my main focus was micro level- health facility and community levels. However, it was necessary to have a more nuanced picture of the practices in whole health sector in order to understand the way data flows into HIS. Therefore, interviews were also conducted at the macro levels –district and ministry levels. Data was collected from representatives of the following stakeholders: mothers with babies (0 to 23 months of age) from both rural and urban areas, skilled and traditional birth attendants and women who assist in deliveries within the study area, coordinators and a statistician at the DHO's office, head officers of the health facilities, researchers who have done related work, chiefs, members of community, national statistical office (staff) personnel and enumerators, and health surveillance assistants (HSAs).

Initially, the plan was to use the Expanded Program for Immunization (EPI) program data in two districts, which later changed to one instead. This change was for two reasons: i) after the situational analysis using secondary data, it was noted that MCH data was most deficient. ii) Using two districts would not have added any new findings and value, but would just make the study too broad. What was important was to ensure that representatives of each stakeholder group whose services related to the generation of MCH data were included.

4.3.2 Ethical Considerations

Clearance was sought from different institutions. The research proposal was cleared by the PhD Board for the Faculty of Science at University of Oslo. The research proposal was also submitted for ethical approval to College of Medicine Research and Ethics Committee (COMREC) of Malawi. Permission to collect data at the study site was sought from the District Health Officer (DHO) of Zomba district. The letters from COMREC and Zomba DHO were used to get permission from coordinators, health facility personnel, and Chiefs in the study area. The permission given by the chiefs was enough for the TBAs, mothers of babies, and other members of the community for interviews and observation. All participants in the study were asked for consent before participating and a consent form (in both English and the local language Chichewa) was read to the participants. In the event that one refuses to participate, their choice was respected.

4.3.3 Methods and tools for data collection

*Crafting Instruments and Protocols*_The research questions determined that the best way to obtain the information was to be engrossed in the context in which the [traditional] practices were occurring. The unit of research was the health sector. I decided to observe people and events, analyze documents and literature, interview, conduct focus groups discussions, and talk to people informally. More data was collected at workshops. For the interviews, data was collected using a combination of field notes, video and digital camera, and audio. Observations helped to understand the invisible work (Bardram and Bossen 2005), for example, TBAs delivery room was observed that she had just completed assisting a delivery, the tools and the dirt had not been cleaned. If our judgment is based on what man says only; we have not done enough research. Much as this was a qualitative research, some guiding data collection tools were devised to make sure that data collected or observed relates to the research questions and is consistent for each group of stakeholders. These tools consisted of (i) interview guides for district health officer; HMIS statistician; programme coordinators; health facility officer-in charge; health surveillance assistants (HSAs); non-public institutions; TBAs, village chiefs, and mothers of babies whose data was collected (see Appendix 6). The interview guides for the TBAs, chiefs and mothers were in both English and Chichewa (local) languages.

All the interviews except for interviews for mothers from urban area, were conducted by the researcher. Interviews of mothers in urban area were conducted by an enumerator. Within the urban setting, most respondents were known to the researcher and some would have been unease being interviewed by someone they know. All interviews were completed using the semi-structured interview approach where guiding questions were prepared beforehand. The semi-structured approach was selected in order to have a standardised focus for all the interviews and discussions. However, where new leads emerged, space was given to follow them. Some of these were followed during informal discussions which proved to be space for interesting topics emerging and more ingenuous responses

The sample size was not predetermined; data collection was stopped when the findings had formed some trends and themes were repeating. The themes are shown in table 7. Another aspect that was taken into consideration was to have representation from different stakeholders that were identified during phenomena conceptualization and after initial findings. For example, in the initial plan, NSO personnel and enumerators were not included. However, the initial findings had to be verified by NSO people, and these were later included. Inclusion of both urban and rural catchment areas, and NSO personnel and enumerators, ensured that all ranges of variations are included.

The mix of data collection methods allowed for triangulation of the findings, as what people say, is it same as they do. Triangulation combines several methods to study one thing. Other than validating, it deepens and widens understanding of human behavior from more than one standpoint (Olsen 2004). Relying on what interviewees say alone may deny the research revelation of what they actually do in their social practices. Observations helped to verify what they say and unfold what they do.

Observation involved the systematic recording of observable phenomena or behavior in the natural settings (Gorman and Clayton 2005) where the data was being collected, in the case of this research, natural settings include health facilities and village committees. The health facilities are places where modern health services are offered to clients. Within the health facilities, clients (including mothers and children under 24 months) receive different types of services from health professionals. The health professionals operate at different levels and departments based on their ranking and qualifications. Within a health facility, there are professionals like clinical officers, nurses, midwives, and HSAs. Other than the health professionals, there are other workers such as cleaners. Each of these cadres has their own job descriptions. A clinical officer or a nurse operates as an officer in-charge and double as the one attending to out-patients. Nurse or midwives are the ones responsible for maternity care. The HSAs operate as community health workers – and have duties both within a health facility and surrounding communities.

For the MoH officials, DHO; and health program coordinators; interviews were used. Within the MoH, key informants were those directly involved with HIS. It was necessary to find out what policies are available on i) data collection and transfer in the health sector, ii) safe motherhood strategies, iii) staff allocations and shortages in different health facilities, and iv) coordination of data from different providers and health programs into HIS. More data was collected from task force meetings that were taking place at the MoH comprising different stakeholders with a common interest of improving standards and quality of health data. The task force meetings were held quarterly. At DHO, health program coordinators were interviewed to establish how they interact with each other by way of sharing data generated from community and health facility level.

Document analysis was also used. This formed a very useful part of the research, the history, procedures; roles of different stakeholders were understood by studying these documents. Documents analyzed include: demographic and health survey reports; Malawi Multiple indicator cluster survey (MICS) reports, integrated household survey (IHS) reports; social welfare survey reports; The Malawi EPI policy document; WHO reports on immunization; UNICEF reports on immunization; MoH reports on immunization, HMIS reports, sexual and reproductive health policy, Malawi growth strategy paper, HMIS bulletins, health facility registers and tally cards, TBAs ANC reports, births registers, village health registers, health passports for children whose data was collected, and other research papers on immunization. Additionally, anecdotal evidence was collected from newspaper articles particularly during safe-motherhood week and from radio and television programs in Malawi.

I also participated in a data standards workshop during this period where issues of setting standards for the data and indicators utilised by HIS were discussed; which indicators to use and how to standardise them. The workshop presented a good opportunity of collecting data from different stakeholders involved in the health sector all at once.

4.4 Data Collection

Entering the Field

As mentioned earlier, the interview period lasted from June 2008 to July 2010. A total of 105 interviews were conducted comprising of: three officials from the MoH, two officials from the EPI unit, four officials (coordinators and assistant statistician for health management information system) from the district health office, four from Christian Hospitals Association of Malawi hospitals, four from a health facility, six HSAs, seven TBAs, 70 mothers, two from the NSO (one enumerator and one senior officer), two researchers, and one chief. Eisenhardt (1989) notes that if the data collection process is implemented during a longer time period, it helps to start analysing the field notes and the empirical material simultaneously with the ongoing data collection process. In doing so, a researcher is able to adjust the data collection instruments accordingly, either by adding new questions to the interview protocol or adding new cases/interviewees to give more insight into the focal object. In this study, some new interviewees were added during the data collection process from the NSO in order to get more specific data from issues that had emerged during the analysis work. The NSO personnel were added to give more insight on the way census and survey data is obtained.

Despite the study being a qualitative research where the sample size is usually small, the sample size in this research swelled due to the number of mothers interviewed (totaling to 70), particularly those from the urban setting. The sample size of mothers from the urban and rural areas was unbalanced. Mothers (60) from the urban area interviewed compared to 10 from rural area. There was need to have a large sample of urban area mothers to find out: i) whether indeed fewer mothers from urban area utilise TBAs, ii) the correlation of those utilising TBAs with their education (and income) level. If only 10 mothers from urban setting were interviewed, the results would have been as if all pregnant mothers in the urban areas utilise modern health sector. Continuing with the interviews in the urban area verified medical dualism and that a smaller percentage utilise TBAs.

The MoH headquarters and EPI officials interviewed were the ones directly involved with health management information systems and immunization data; at management level and data processing level. The interviewees from the MoH headquarters were from the HMIS unit – those directly involved with HIS. The purpose of interviewing EPI officials was to emphasise that data collected by different health programs vary despite coming from the same source. Further the two units (HMIS and EPI) illustrate the value in connecting across boundaries and sharing data and knowledge. The two units came up with a solution where data (on immunisation) collected by EPI unit would be used by HMIS as well because it was deemed more accurate. This required “a pragmatic boundary” for the different units to work effectively together, sharing each others data Cf. (Carlile 2004).

At district level, coordinators for health programs dealing with maternal and child data were selected and statisticians responsible for processing health management information system data. Interviewing the program coordinators revealed contradicting stories- that i) they meet to discuss common issues and ii) that each program have its own reporting structures.

From the health facility, the officer in-charge and maternity ward nurses were interviewed. The HSAs interviewed were the ones who were available during the days of visits, and two were specifically chosen because they were responsible for the villages which were studied. The interviews were also valuable from the data triangulation perspective as they were carried out to individuals with different levels and responsibilities within a health facility. The visits made to conduct interviews also provided opportunity for observation. It was observed that much as each cadre within a health facility have their own job descriptions, staff shortages sometimes dictated otherwise. In some cases, a cleaner was observed attending to a pregnant woman or an HSA attending to out-patients. Such incidents may not be reported during interviews, but through observation. In some cases, the whole facility was left to be manned by one nurse. A good example is where I observed one nurse attending to maternity cases, out-patients, and during that period, there was Cholera outbreak and the nurse was also attending to Cholera patients. In addition, this nurse was supposed to record the data in the registers. As I happened to visit the health facility that day, I also wanted to be attended to as a researcher. The fact that the nurse was busy gave me as a researcher more time to observe the activities.

Mothers of babies were also observed both within the health facilities and while conducting interviews in their communities. During one of the visits at a health facility, I observed a mother who had delivered within the night crying out for help as she was feeling feverish. Much as the nurse wanted to assist, there were also other pressing cases in the out-patient department requiring her attention. It took quite a long period before the mother was attended to. Despite the nurse being a member of health professions CoP whose common concern is promotion of safe-motherhood; what was observed was contrary.

Other than mothers, TBAs were also interviewed and observed. Whilst all TBAs said that they were stopped from conducting deliveries, observations and informal discussions revealed a different reality, that they still conduct deliveries. An example is where one TBA was observed to be very tired and sleepy during interview and later during informal discussion revealed that she had a client until early morning hours. Another example is where client's relation (grandmother) interrupted during interviews and was asking for grand-daughter who came during the night for delivery.

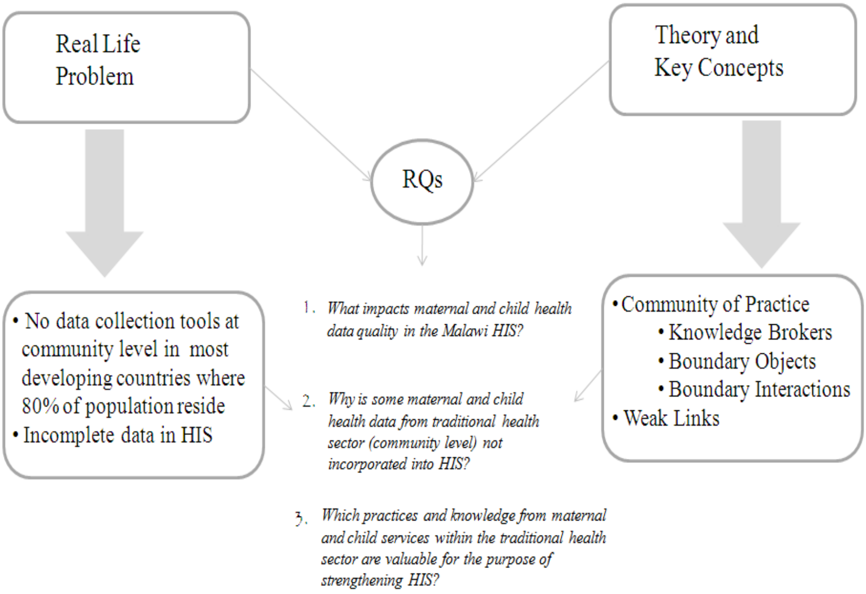

Figure 5– Phenomena, Key concepts, and Research questions

For the mothers, door-to-door visits were made, and households having babies under the age of 24 months and willing, were interviewed in both the rural and urban settings. During these visits, observations were also done. The number of mothers interviewed was determined by repeated patterns of the findings.

As Walsham (2006) noted, "continued involvement with the field situation, regardless of one's starting position, can push the researcher towards a more involved stance" p.322 from being an "outside researcher" to being an "involved researcher". He describe how Walsham and Sahay (1999) faced a situation where they started off as relatively neutral and ended up being involved, offering direct advice and help to the field personnel. Their argument was that they felt it was appropriate and only fair to do so, as refusal would have been interpreted as lack of concern by the researchers. The experience which Walsham and Sahay (1999) shared in their paper is important to my research as I faced a similar situation where after two years of interacting with one community in one of the study sites, they felt at ease and would ask for advice, resources etc. They saw me as a link between them and the health sector. Based on the phenomena, identified gaps, and literature review process; theory and key concepts that helped come up with research questions were identified (see figure 5). The research questions guided the data collection process.

4.5 Data Analysis

Different strategies can be adopted to make sense of the data collected, trying to create an explicit picture that reflects the situation on the ground. As a researcher, I was cycling back and forth between process theory and process data to produce process knowledge (Orton 1997). Beginning analysis during the data collection was almost inevitable because, being in the field, collecting data, it was impossible not to start thinking about the data being collected, what was being observed and discussed. "… carrying out of fieldwork is the fundamental basis of any interpretive study" (Walsham 2006): p.321. According to Walsham (2006), "all fieldwork is context-dependent and requires difficult choices to be made" (p.321). These choices do not only depend on the context; but also on preferences, opportunities and constraints (Walsham, 2006). All the data was handled by the researcher to ensure that the data is secure and confidentiality is guaranteed. Analytical memos were used to record the field observations and findings. The field notes were hand written, and in some cases graphics in the form of digital photos were taken.

In the process of collecting data, what was more important from the beginning was to establish whether pregnant women give birth outside health facilities as is reported in the documents analyzed. It was established that much as a high percentage of pregnant women attend antenatal care in the health facilities both in rural and urban areas, when it comes to delivery, most women in the rural settings utilise TBAs. Once this was confirmed; I wanted to establish whether babies born within communities are taken to health facilities for check-up. This revealed three different trajectories. Some are taken for check-up and vaccination, some are taken only when they fall ill, and some who never visit the health facility. I also identified the factors within the context that influence mothers' behavior. To make sense of the way data is communicated, I came up with data displays (see figure 6).

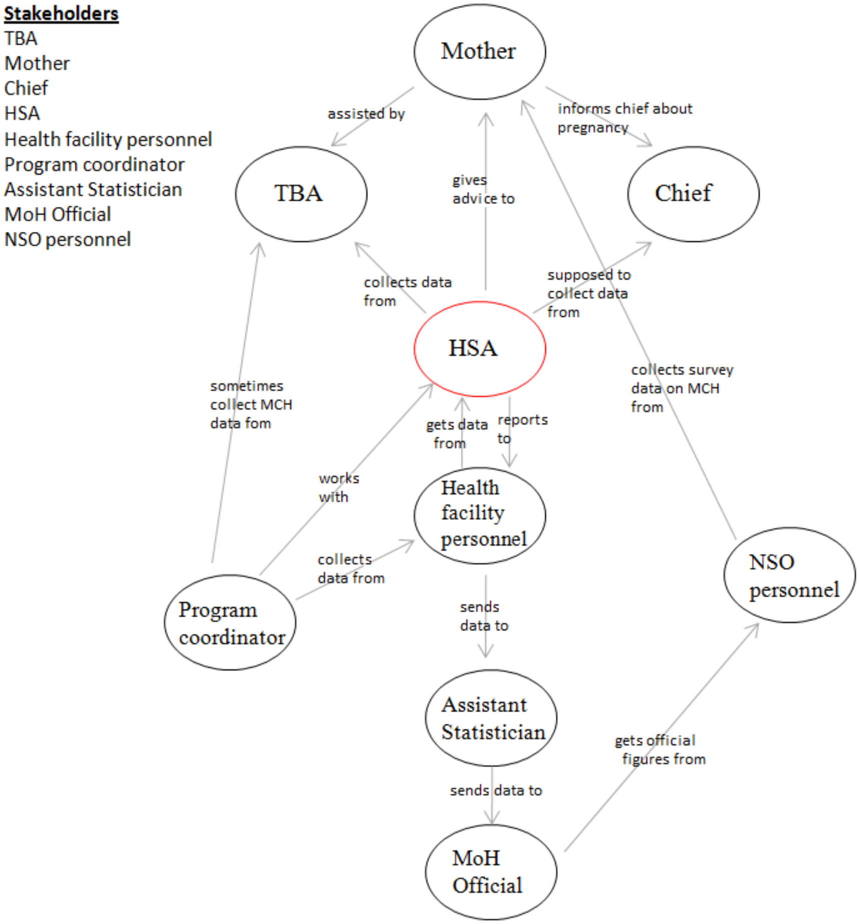

Figure 6– Actors interviewed and their relationships

The data display identifies different actors in the health sector and the context that relates to phenomena being studied, and illustrates how these actors link. The relationships between the different actors are also indicated (see figure 6). The data collected at the different health sector levels was then divided into three stories, each representing the three trajectories mentioned above. As mentioned earlier, the iterative and simultaneous nature of data collection and analysis required validation of some of the preliminary findings. This is how National Statistics Office (NSO) personnel came into the picture.

The data display is consistent with the fact that HSAs are the only link between modern and traditional health sector. Figure 6 indicates that HSAs interact with almost all actors (directly or indirectly) except for NSO personnel who are not part of the health sector. The displays helped to put the puzzle of how different actors in the modern and traditional health sector interact and helped to visualize and understand the research results. HSAs interact with both the modern health sector through the health facilities and traditional health sector through their surveillance activities. In some communities, HSAs attend the village safe motherhood committee meetings. The fact that HSAs interact with both modern and traditional health sectors make them better placed to act as brokers.

Relating the findings to the research aim and literature in the IS field, I organized the results according to the theoretical concepts (i.e. local knowledge, knowledge brokering, boundary objects) and other supporting concepts - like *traditionality, modernity marginalisation* and *weak links* - which helped to make sense of the data and the different themes that emerged. The *traditionality* and *modernity* concepts helped to emphasize the cultural systems, discourses, history, and the situation of the health structure as it is. Underlining the fact that narrowing the gap between modern and traditional sector in the way data is shared, can strengthen and enhance health sector effectiveness. In this thesis traditionality is not synonymous with primitive and backwardness. It is used in a positive way arguing that despite the health sector undergoing modernisation, traditionality has remained legitimate and relevant.

The identified themes were guided subjects presented and discussed in different peer-reviewed papers. From data collected, five themes – i) births, ii) pregnant women condition during labor, iii) traditional births attendants (TBAs), iv) new born babies, and v) health surveillance assistants (HSAs) were identified. Table 7 illustrates the themes and their descriptions.

To ensure quality analysis, Klein and Myers (1999) principles for interpretive field studies in IS were applied through out the process of collecting and analysing data. The central principle used was the hermeneutic circle and the different parts (community, health facility, district and the different stakeholders therein) interdependence and how they contribute to HIS were critically analysed. The principles of contextualization, interaction between the researchers and the subjects, abstraction and generalization, dialogical reasoning, multiple interpretations and the principle of suspicion were also applied to the data. However, these principles were not applied explicitly.

Table 7 – Themes and their descriptions

Theme	Description	
Births	• Where they take place	• Health facility • TBAs place • Home • On the way
	• Who assists the pregnant women	• Professionally trained (skilled) birth attendant • Unskilled birth attendant • Relative/Friend
Condition of woman during labour	• No complications	• Have delivered normally before • Baby position ok • HIV negative
	• With complications	• First baby (primgravida) • Breach cases • Premature baby • HIV positive • Cervix problems/hemorrhage
TBAs	• Trained • Untrained	• Experience • Record data or not • What they do when faced with an emergency • With or without room for deliveries
New born babies	• Immunized • Unimmunized	
HSAs	• How often do they visit communities	

Given the 80/20 rural urban dichotomy of Malawi's population, most mothers and under five children particularly in rural areas face challenges accessing health facilities. Of the 70 mothers interviewed during the study, only 2% of the pregnant women from an urban area utilised traditional births attendants, 85% from rural area attended antenatal clinic at health facilities; however, only 10% of the pregnant women from rural areas had their babies delivered by professionally trained personnel. The rest delivered their babies at traditional births attendants or at home. Combining both rural and urban areas, we get an average of 46% pregnant women utilising traditional health services. There is a 5% variation with the NSO figures reported at 40% (26% delivered at TBAs, 14% at home). With a significant number of people utilising the traditional health sector which have elusive data collection mechanisms, most data generated is lost and HIS ends up having incomplete data.

For babies delivered at home there is a high chance of missing postnatal monitoring within the critical period (the first 24 hours). This may lead to an increase in both the number of deaths occurring at homes and data that is not reported (births, deaths and causes of deaths) into HMIS. To curb the maternal and neo-natal deaths, the Ministry of Health (MoH) introduced the sexual and reproductive health and rights (SRHR) policy in January 2007.

The health data that feeds into HMIS is generated and collected at community and health facility levels and uses wide range of data sources; both routine and non-routine. The sources include: the census; the registration of vital events; health facility based records; community monitoring reports; population surveys and research; and records from central ministries and institutions. At community level, data is collected by health surveillance assistants. According to policy, the health surveillance assistants are supposed to collect data from villages on a daily basis. However, the health catchment areas which they serve are too wide, dense, and with long distances to be covered on a daily basis. As a result, the health surveillance assistants visit their catchment areas on a monthly basis. In addition, the roles of the Health Surveillance Assistants were extended, making it more challenging for the health surveillance assistants.

In the HMIS bulletins and national statistics office survey and census reports, variations are evident on the figures reported by HMIS (for antenatal visits, and trends in delivery by trained health personnel) and the ones reported by the national statistical office (NSO) surveys, census. The two use different cohorts as a measure, HMIS data indicates babies in the age bracket of 0 to 12 months while the NSO data use children in the age bracket 12 to 23 months. However, the pattern reported by the two is at odds; whilst 'HMIS is showing an increasing trend [for fully immunised children], the demographic household survey is revealing a long-term declining trend.

Limitations are evident in the health sector. Firstly, there is uneven distribution of staff within the health sector. One of the officials at the ministry of health headquarters said:

Although we have now recruited a total of 13,000 health surveillance assistants to cater for the recommended 1:1000 HSA to population ratio; these have been unevenly distributed.

Secondly, across the four levels of the health sector, performance and management and reporting systems are lacking due to challenges in human resources. This contributes to the low data quality in terms of completeness, reliability and timeliness as districts and facilities submit delayed and incomplete HMIS reports. Thirdly, there are two sets of collecting tools for some data; one belonging to HMIS, the other vertical programme owned. The way data is collected from community level remains elusive as there are still no structured data collection mechanisms in place. Fourthly, the projected figures which the program coordinators use have changed due to census population - up to 2008, the figures used were projected from the 1998 census data; since 2009, projections are from the 2008 census data.

The high turn over of district health officers (DHO) and health staff in general pose another challenge. A Programme Coordinator early 2009 at a district had this to say: Since July 2007, there have been four DHOs. Human resource shortage is a serious problem. At the health facility studied, the staff is overloaded with work. At times one nurse has to man the maternity wing, outpatients, immunisation, and cholera camp. In addition, the same person has to fill in all the different forms as demanded by different vertical programmes and HMIS. When the professional health staff is tired or has too much to do, transcription of data is done by non-clinician staff. Loss of clinical details (usually no age/sex detail) was observed in the log books.

Now that the roles for TBAs have changed, the data of the deliveries by the TBAs per month is not reported to the health centers. TBAs stopped recording births and they operate under ground. Prior to January 2007, the data from TBAs were being recorded and health surveillance assistants would collect it on a monthly basis. However, it was observed that the data from TBAs was not always transferred into the facility registers as they did not have columns for births at TBA and home. In 2010, new registers were introduced covering births at TBA and at home.

Birth certificates are not given at birth at health facilities and registration of the births is not always accurate. For example, at the health facility studied, 646 deliveries were recorded in 2007 in the registers at the maternity ward, and 712 in 2008 out of the 735 and 790 admissions respectively. This can be explained by the observations made when the health facility was visited that 3 days or a week would pass without daily deliveries being recorded in the register. Sometimes the nurses would be too overloaded and not have time for recording births in the registers. At community level, the way data are captured have its own challenges. Although the policy at ministry level is that healthy surveillance assistants (HSAs) should be residing in the communities which they serve, not all of them live in the communities, some live at the trading centers close to the health facilities. This is the case due to different reasons:

I live at the trading center; at least the water there tastes better. I can't stand the taste of this water, it is very salty and when you drink it, your throat feels dry (HSA1).

Can you see how far this village is from the health facility; one gets tired going round the villages everyday without provision of transport [bicycles]as a result, I do not come daily (HSA1).

Most HSAs do not like this place because there is no electricity, the markets hardly sell meat and things are expensive because they are scarce due to the long distance from town (HSA2).

Not all data for all deliveries at the TBAs are collected. Each HSA is responsible for several villages within a catchment area. The HSAs collect health related data from traditional births attendants (TBA) and village chiefs. However, the chiefs hardly record data. Prior to the policy of banning TBAs from conducting deliveries, HSAs used to collect data relating to pregnant women and births from TBA report books and birth registers within communities on a monthly basis. Each HSA would record the total number of births assisted by each TBA and the number of pregnant women attending antenatal care at that particular TBA. The data would then be reported to the TBA coordinator and the nearest health facility. After the policy was effected, most TBAs stopped recording the data. Conducting deliveries was a source of income for the TBAs within their communities. For each delivery, they used to charge MK200 – MK300 (US$2.10). After SRHR policy implementation, women within communities are being advised to inform their chiefs once they are pregnant so that the chiefs can conduct follow ups i.e. encouraging them to go for antenatal and delivery at a health facility. However, this met some negative views from some of the women; a mother of 8 months baby in village X had this to say:

Why should I tell the chief of my pregnancy as if he is my husband?

As a way of discouraging women to deliver at TBA, those who deliver at TBA are charged chindapusa (penalty) in the form of goat or in some cases chicken or cash to the tune of MK500 (US$3.50). The penalty is given to their chief. Within the rural villages however, most women believe that TBAs are more caring when it comes to assisting a pregnant woman during births. As a result, they still prefer utilising TBAs as opposed to health facilities with professionally trained nurses. The TBAs also face a predicament because implementation of SRHR policy meant losing their source of income. In some cases, both pregnant woman and TBA go ahead with deliveries, knowing very well the consequences. Another reason why pregnant women in the health catchment area shy away from the health facility is the fact that they would rather deliver a baby at TBA's place than go to the health facility where many women would be waiting and some being delivered by cleaners not the much publicized professional health personnel. They do not want to add to the statistics of institutional delivery when in actual fact it is "institutional attendance birth". There are also other cases where labor pains would be advanced and pregnant women may not have a chance to reach the health facility.

The results of this study will be disseminated to the Ministry of Health, Universities of Malawi and Oslo and through publications and papers presented at conferences, workshops, and published in IS and Health journals. This thesis also forms part of the dissemination.

4.6 Personal Reflections

As they say, an interpretive researcher needs to include "confessional accounts" encountered in the process of doing research (Van_Maanen 1988). Much as it is easy to talk about what you plan to do, it is not the same when it comes to writing it. Partly because as we converse; the listener has a chance to seek clarification and probe for more information to enhance their understanding. That chance is not there once it's a written document, everything has to be convincing at once.

Recalling the process, it was hard not to include what is meant to be the findings and conclusions in the research proposal. The reason was because of "subjective idealism" as Walsham (1995) call it, where reality of the phenomena context would be constructed before research was done. A comment from one of the professors brought some direction - "why do you want to study this if you already know the results?" This meant more literature review to be able to identify the gap to fit within the field of information systems. What was easier in the research proposal was the motivation as it is based on personal interest; however, relating it to the gaps in a body of knowledge was not. This brought more questions than answers– What literature do I review? How to phrase the research questions to reflect the problem being motivated? Going through theory and research methodology courses helped to answer some of the questions.

When I started I was anxious with a number of issues: whether this was the right topic, whether getting access would be easy, whether I would not tread on peoples toes along the way by asking sensitive questions.

4.6.1 Challenges encountered during generation of data and access

It was difficult to interview health facility staff when they had queues of patients to be attended to; same was true for the health staff in the labor wards; and the DHO coordinators when they were rushing for meetings or outreach programs. In some cases the interviews had to be rescheduled several times.

Research reinforces knowledge and uncovers new information, but a researcher is not able to communicate all the information as a decision has to be made of what story to tell and how to tell it (Byrne, 2001). Within the health sector environment, events result in multiple factors coming together, interacting in a complex and often unanticipated ways (Strauss; p.8). Since capturing all complexity is impossible, a perspective on the events is obtained.

Initially, it was hard to be specific on which data to collect; I started by collecting data from two programs – Expanded Programme on Immunization (EPI) and Maternal and Child Health (MCH). Then I noted that most of the EPI data required for the study is part of the MCH, and I dropped the EPI program.

During data collection process, there were variations on how to approach the villages being studied. For some, permission had to be sought from a chief before interviews. Chiefs have a right to be notified of any strangers entering their villages and why they are there. The mode of dressing also had to conform to the community way of dressing to avoid having *them* and *us* situation. This included placing a *chitenje* (wrapper) on top of a dress or skirt. Most data was collected in local language. This required translation to English before analysis. Translations were made by the researcher.

Another challenge was the process of coming up with a research proposal. My experience was that the research proposal that was acceptable for the PhD board was not good enough for the ethical committee; as they had their own format and requirements. Certain things had to be removed and some added. Then there was a long wait for ethical approval before data collection started.

5 Research Findings

5.1 Research Papers

The empirical findings covering the theoretical concepts and different factors that affect HIS data quality are presented as five peer-reviewed papers. The papers have been summarized in this chapter. The title of the papers are as follows:

(i) Rules, Reality and Results: Inter-Institutional Coordination and Impact on Health Information Systems in Developing Countries, Kanjo C., and Kaasbøll, J., Published in Molka-Danielsen, J. (Ed.): *Proceedings of the 32nd Information Systems Research Seminar in Scandinavia, IRIS 32*, Molde University College, Molde, Norway, August 9-12, 2009.

(ii) Pragmatism or Policy: Implications for Health Information Systems (2011). Kanjo C. *Electronic Journal of Information Systems in Developing Countries*, Vol. 48 (1), pp. 1-20.

(iii) Making Data and Knowledge Visible for Health Information Systems. Modified from: Kanjo C., and Kaasbøll, J. (2011), Data, Information and Knowledge: the greatest of all is Knowledge, *IFIP WG 9.4: Social Implications of Computers in Developing Countries Proceedings,* 11th International Conference: Partners for Development - ICT Actors and Actions, Nepal.

(iv) Influence of Information Generated from Traditional Practices on Health Information Systems. Kanjo C., and Kaasbøll, J., Published in *IFIP WG 9.4: Social Implications of Computers in Developing Countries Proceedings*, 11th International Conference: Partners for Development - ICT Actors and Actions, Nepal. 2011.

(v) Strengthening the Link between Traditional and Modern Health Practices for improving Data Quality in Health Information Systems: Case of Malawi (2012). Kanjo C., *Electronic Journal of Information Systems in Developing Countries*, Vol. 53(2), pp 1-17.

The findings from the papers are presented in section 5.2.1 to section 5.2.5 below. All the papers used the Malawi health sector case, focusing on maternal and child health data.

5.1.1 Rules, Reality and Results

In this paper, the broader issue of how factors such as policy implemented within the context of the IS can have an impact on the data quality is reflected. This paper addresses the effect of the sexual and reproductive health and rights policy. The paper analyzes and discusses the mismatch between rules of changing TBAs role from assisting deliveries to advisory. Reality on the ground is that there is a shortage of professional health personnel and facilities to cater for all pregnant women. As a result, pregnant women continue utilising TBAs during deliveries. Although the TBAs assist with deliveries, they do not record the data. This causes data to be "lost".

This paper aims to identify the extent which the informal and formal health providers coordinate and how much information from the informal health providers, with specific focus on the traditional birth attendants, is integrated into the national HMIS. This will take into consideration the existing rules in the health care system and the reality on the ground in the rural areas. While the existing rules ban the operations of TBAs, the general population sees the TBAs as being responsive to their needs. This results in weak links in the HMIS as some information which could have been captured from the TBAs end up being missed as they don't report from fear of infringing the rules.

The findings of this study point to two weak points in the process of collecting data that feeds into HMIS. (i) After the TBA ban, most of the data from trained TBAs is lost. Before the TBA ban, information feeding into both HMIS and EPI unit was flowing systematically from community to health facility level. This was due to the fact that the TBAs used to record antenatal and birth details in the report books and birth registers which was collected by HSAs on a monthly basis. The only exception was data for births delivered by untrained TBAs who do not have report books and birth registers. Even before the ban, these were not recognized by the Ministry of Health; as such they were operating illegally. Currently, both trained and untrained TBAs do not record the births for fear of being penalized. (ii) The data being collected from the legitimate sources is aggregated and reported differently. The data reported to the EPI Unit is reported on a monthly basis, whilst data being reported to HMIS is reported on a quarterly basis. At most health facilities, the data is collected and kept on loose forms, and there are chances that some of these forms can be misfiled or lost particularly in cases where the forms are left with someone else other than the responsible officer.

5.1.2 Pragmatism or Policy: implications for HIS

This paper describes and analyses some of the factors that affect HIS success in developing countries. The aim of this research was to identify, within the environment where the information systems are implemented and used, issues that could be stumbling blocks to their success. Although the use of HIS is seen as a satisfactory outcome of health sector reform, there are certain social aspects, both internal and external to the organization and system that influence its success or failure. The challenges of success lie in the heterogeneity of the players, requirements, practices and policies in place. In some cases, national policies affect the success of information systems.

For this paper, we specifically examined the extent to which Sexual Reproductive Health and Rights (SRHR) policy, which includes stopping traditional birth attendants (TBAs) from assisting in births, affects maternal and child data flow from communities to health facilities and hence into the national HIS. The SRHR policy was introduced as a way of curbing maternal mortality in a bid to attain the fifth Millennium Development Goal. The findings reveal that external factors, such as SRHR policy implementation, caused TBAs to stop recording and reporting data for health surveillance assistants, and this affected the quality of data that is input into HIS. Recommendations of a more pragmatic approach when implementing SRHR policy are provided.

Practical implications of this research focus on the need to critically assess reality on the ground that may enable or limit the completeness of data and distort the information produced by an information system. It is clear that each context where an information system is developed remains unique. In this case, a constraint on an information system arose after the system had already been implemented, yet it hindered the completeness of the data collected.

While HMIS development is seen as a satisfactory outcome of health sector reform, it takes the post-functionalist view (Iivari, Hirschheim et al. 2000) of an information system, as the completeness of the health information is disrupted by SRHR policy implementation. The implementation of HMIS therefore only reveals the government's attempt to strengthen health care services, but with an accompanying insufficient situational analysis. Consequently, these actions do not have the intended effect on health planning and status, as the outcome does not represent the reality on the ground. Success takes a balance of forces but technology is always never sufficient (Morton 2000) . What matters is the way that the different players coordinate and carry out a continuous evaluation of systems. It is not only the technology or the inclusion of the social aspects that leads to successful implementation of an information system, but also continuous human vigilance.

5.1.3 Making Data and Knowledge Visible for HIS

In this paper, the way data used for denominators in HIS is collected, the data collectors, and sources are analyzed. Two sources were identified, the national statistics office (NSO) surveys, and the health facility head counts. NSO data is collected by enumerators who may not be familiar with the communities. On the other hand, head counts data is collected by the HSAs. HSAs live in the context where they collect their data, they interact with the community members and are able to construct local knowledge that helps them understand the communities which they serve. However, the experiences and practices encountered within a context are not shared due to the organizational rules in place. This paper highlights why most data and knowledge remain invisible in the traditional health sector and why some data sources are considered less credible. Two issues were highlighted in a bid to improve the way data is collected at community level and as a way of helping curb the problem of having incomplete data in HIS. The paper also highlights the challenges encountered during data collection related to the data collectors and data sources.

The NSO enumerators' main and most reliable source of maternal and child health (MCH) data during the surveys is from mothers' health passports. Ironically, the health passport data comes from a health facility, and not all mothers within a community would have health passports. Therefore, the reliance on data collected using respondents' health records excludes a good proportion of the population which has no access to health facilities. However, there is a lack of knowledge about the real source of survey MCH data. This lack of knowledge leads to a situation where the health sector uses less accurate data - projected National Statistics Office (NSO) figures to distribute supplies, leaving out the head counted population figures that are more credible. Although the health sector as an organization has all the data needed to produce information for decision making, the contradiction of data sources is not visible within their IS. The health sector's most trusted statistics remain those from national surveys.

The knowledge of this contradiction and utilization of the local knowledge generated at community and health facility level can improve the quality of data used in the health system. Here, the social status of where the knowledge is generated from comes into play; since the NSO is the official institution, the data and knowledge from there is considered to be more credible than that from communities. Further, the knowledge possessed by the rural communities is overlooked, ignored and considered less credible.

The paper concludes that it is important to utilize local knowledge that is situated in the context where relevant data resides, to ensure that no data is missed. Externalizing and sharing the local knowledge that resides within communities and specifically among traditional health providers can help externalize other human practices and make data generated within communities visible. Understanding the existing and emerging knowledge can lead to effective strategies to strengthen the health systems. MDGs four and five use maternal mortality ratio and under-five mortality rate as indicators; making data generated within communities visible would improve the MDGs indicators, otherwise better information and determinants of attaining health-related MDGs remain a challenge.

Although the analysis was done using the Malawi health sector case, aspects of local knowledge not being shared is part of most organizations. These are more pronounced in cases where there is a dualism (formal/informal, rich/poor, modern/tradition, urban/rural) where one side is seen to be superior to the other. Here NSO generated population data is seen to be more credible compared to the health facility generated data, despite the contradictions. Organizations need to go beyond the social status and utilize the local knowledge that is situated in the context where the relevant data reside to ensure that no data is missed. We cannot get it right at a local level without the local knowledge which is the human capital.

5.1.4 Influence of Information Generated from Traditional Practices on HIS

This paper analyses the disconnect that often occurs when dealing with introduction/implementation of modern healthcare technologies and traditional health practices. The paper describes why some information from traditional providers fails to find its way into national HIS. The impact which the dual legacy of modern and traditional providers has on delivery of maternal and child health service, the achievement of the Millennium Development Goals and the comprehensiveness of HIS is also established. It is conventionally thought that modern technology will also modernize the traditional practices. However, this is not the case in many settings where the traditional practices fit the economic and social life of the people. This is especially true of health-related technologies and practices in developing countries. This paper presents this dilemma. Although mothers in Malawi still use traditional births attendants for childcare delivery, their data is not collected and entered in the health information systems.

Community of practice concepts are used to understand the mechanisms that affect data collection and the way data flows from one level to the other in the health sector. The paper identifies five different CoPs (i.e. village committee, health surveillance assistants, trained health personnel, coordinators, and policy makers. Village committee has diversity in terms of members, with people with different skills and orientations but they all share common concerns and goal; that of achieving safe motherhood. Focus is on community level where information is generated from traditional practices. Although many pregnant women attend antenatal clinic at health facilities, they tend to shy away from health facilities during delivery and end up delivering their babies at home or at a traditional birth attendants. The interviews conducted confirm that most (90%) mothers in rural communities delivered their babies at home.

The paper emphasizes the fact that implementation of IS in healthcare system without a clear understanding of the CoPs remains mythical and ceremonial as articulated by Noir and Walsham (2007). To make sense of the way data flows from one CoP to the other, there is a need to understand the mechanisms that link the CoPs. To establish the links between CoPs, we introduced the concept of chain of CoPs. We conclude that there is a weak link in the chain of CoPs between the community and health facility level; causing most data generated from traditional practices to be missed. This is a result of lack of mechanisms for data collection at community level since TBAs stopped recording data due to change in policy. The missing data from the traditional practices means excluding most data from 80% of the population. This may derail the attainment of fourth and fifth MDGs as planning and decision making is based on information that does not reflect the situation on the ground.

In developing countries weak links in chains of CoPs may apply particularly in contexts where there is interplay of traditional and modern practices. The mode of communication in these contexts could be oral, hand written papers, electronic, or through brokers. The hand written papers and electronic messages are boundary objects; on the other hand, oral messages are boundary interactions. Within the traditional health sector, only boundary interactions exist. In the modern health sector, both boundary objects and interactions are used. Where boundary interactions (oral messages) only are used, the links are weaker, therefore, CoPs that communicate using boundary interactions (orally) are considered to be weak linked. We propose the need to capture data passed by all forms be it oral, hand written, or electronic within the different communities of practice.

The paper also highlights weak areas and how health information from traditional practices can be better utilized by strengthening the communities of practice - a necessary ingredient towards the attainment of the MDGs. In strengthening the communities of practices, members increase their participation and interactions and they become more empowered, as there is strength in numbers. As a result, they can articulate their health needs with one voice. This helps to make data created within their communities more visible through the interactions within and across CoPs and can enhance development. Much as it is an example from Malawi, a developing country, has been used, community empowerment is necessary in all underserved and disadvantaged settings across the globe (Wallerstein 1992; Walters, Walters et al. 2010).

5.1.5 Strengthening the Link between Traditional and Modern Health Practices

This paper uses community of practice (CoP) theory and illustrates how knowledge brokering across CoPs can enhance the flow of data from traditional to modern health sector. In this case, like Ethiopia (Damtew and Kaasbøll 2008; Damtew, Kanjo et al. 2010) and India (NRHM 2010), the only link between the two health sectors is a cadre of community health workers. In developing countries where health sectors have two systems, traditional and modern, and an acute shortage of medical staff within the modern health sector, most people use the traditional health sector. This is more so in rural areas where most of the population cannot access or afford modern health services. However, weak linkages exist between the two health sectors resulting in poor data flow from traditional to modern health sector. With the poor linkages, problems in the traditional health sector are not visible to the modern health sector. The paper analyzes the situation to provide an understanding of the nature of the weak linkages between the modern and traditional health sectors and how the link can be strengthened.

Within the health sector, when policy makers and health managers focus on practices within different groups, it affects not only the health practices, but also the way health information is reported. As articulated by Lave and Wenger (1991), expertise can be developed through prolonged participation in a community of practice. Much as this is the case in the modern health sector, the expertise developed in the traditional health sector is slow in gaining recognition despite the fact that it plays an important role in generating information relevant for HIS. Linking indigenous knowledge gained from practices and HIS utilization can provide a new understanding of collecting and reporting data from communities by the community health workers. Therefore, it is very crucial to nurture the practices in the traditional health sector and ensure that knowledge created is transferred and used in the modern health sector. With the 80/20 dichotomy of the rural vs. urban population in Malawi, the traditional health sector generates considerable data which needs to be included in HIS.

Unless the relevance of the data and knowledge that is created within the traditional health sector is recognized, the link between the modern and traditional health sector will remain weak. In the traditional health sector, one instance of community of practice was identified; this is the village safe motherhood committee. In the modern health sector, instances of communities of practice were also identified at each level. HSAs belong to two communities of practice, the one in the traditional health sector, and the one at the health facility level in the modern health sector, hence they also act as knowledge brokers.

From this study, it was concluded that the HSAs can enhance the sharing of knowledge across communities in the health sector. This study illustrates that utilization of knowledge brokers improves the sharing of data and knowledge across sectors, particularly in countries like Malawi, Ethiopia, and India where community health workers are the primary link between the traditional and modern health sectors.

5.2 Communities of Practice within the Health Sector

This section is a synthesis of the CoPs identified from the empirical findings, which the discussions in the papers above made reference to.

Different communities of practice were identified within the different health sector administrative levels, the strongest being the *village committee* CoP at community level within the traditional health sector. Other CoPs include the *trained health personnel*, and the *health surveillance assistants* at the health facility level in the modern health sector. These three CoPs are crucial as not only do they belong to different health sectors –the traditional and modern, but of particular interest is that the HSAs CoP's membership shares its practices with both village committee and health personnel CoPs. The CoPs were analysed based on the seven principles of cultivating CoPs (Wenger, McDermott et al. 2002).

5.2.1 The Village Committee CoP

Design for Evolution Principle - This CoP evolved from preexisting personal networks of TBAs, chiefs, HSAs, and interested other members who had a passion for safe motherhood issues within their villages. The CoP started when the TBAs were stopped from assisting with deliveries as part of the SRHR policy implementation. Within the catchment area studied, incidents were reported calling for TBA's assistance when it would be identified that pregnant women are requiring assistance to deliver on their way to Pirimiti health facility. As a way of avoiding such incidents, one of the TBAs championed the formation of a committee looking into safe motherhood issues. The aim of the committee was to ensure that members of villages (particularly pregnant women) are aware of the measures to be taken to avoid delivering on the way. The TBA coordinator from the district health office and chiefs and fellow TBAs in the neighbouring villages were contacted. Having interested and convinced the initial group, more members with a passion for safe motherhood joined. Most members participating in the village committee were female.

Open Dialogue Between Inside and Outside Perspectives – this CoP has different inside perspectives i.e. TBAs who had the know-how of assisting deliveries, chiefs inside perspective with knowledge of their people within their villages. At the very beginning, the TBA coordinator was representing the Ministry of Health (outside) perspective, this role was later handled by HSAs.

Inviting Different Levels of Participation – the village committee CoP operates at different levels as the group comprises members from different villages. The "core" group therefore has the responsibility of going out to the different participating villages to advise pregnant women on safe motherhood issues. The one who championed the whole thing remains the coordinator of the group.

Developing Public and Private Community Spaces – the village committee CoP develop public space by having meetings where all members gather on a weekly basis. On the other hand, the coordinator and members of the organising group work privately, strategising on activities to be carried out in respective villages where their CoP members come from.

Focus on Value – the champion of this CoP is a TBA who committed to put the group together and ensure that pregnant women in villages whose chiefs participate have been advised on the benefits of utilising the health facility during antenatal, delivery, and postnatal related care. The progress of the pregnant women during their pregnancy is closely monitored and some who may have questions do have people to reach.

Combining Familiarity and Excitement – with time, the CoP have settled into a pattern of regular meetings. These meetings are spiced with songs and dances offering excitement and giving educative messages to those around. Once a year, they plan a get together where they invite district health coordinators, updating them on their work.

Creating a Rhythm for the Community – regular weekly meetings, village visits to advise pregnant women in their respective villages, following up on those pregnant women who did not report to the health facility is the rhythm for this CoP.

5.2.2 The Health Surveillance Assistants and Health Personnel CoPs

Design for Evolution Principle – unlike the village committee, these two CoPs comprise health sector professionals, whose interest among other things is to capture as much data as possible generated both within health facilities and communities. The HSA CoP evolved from the pre-existing network of HSAs, in addition to their work, they dedicate part of their time in sharing experiences and trying to make sure that they reach out to all the villages allocated to them and collect the data. The HSAs noted that the distances in the villages which they serve are too long to be covered on a daily basis. As a result, they teamed together, sharing practices so that they speak with one voice to their superiors. They devised monthly timetables to be followed and as a way of easily tracking their activities.

The health personnel CoP, on the other hand, is led by the health facility in-charge, with all health personnel as participating members. They meet on a weekly basis. They reflect back on their weekly activities as they plan and strategise on the way forward. Other than doing their designated work, these meetings help them to learn from each other, interact easily, and to allocate duties to other personnel when they have staff shortages. Sharing the experiences improves their understanding of the situation on the ground. For example, there would be cases where an HSA would do the work of a nurse like vaccinating babies if the nurse is very busy or sick. This may not apply in other health facilities where they have more than one nurse.

Open Dialogue Between Inside and Outside Perspectives – both CoPs have inside and outside perspectives i.e. the HSAs interact with the other two CoPs and they share the village committee and health professional CoPs perspective.

Inviting Different Levels of Participation – the health personnel CoP comprise people with different levels of qualification and skills. This gives them a chance to share experiences. The HSAs, though with same level of qualification, their level of experience varies.

Developing Public and Private Community Spaces – both CoPs develop the public space by having weekly meetings.

Focus on Value – the value of these CoPs is ensuring that health-related data generated from both health facilities and within communities is collected. Collection of head counted figures by the HSAs as one the values.

6 Contributions and Conclusions

This chapter discusses the contributions made to the research. The chapter has been organised around the three research questions posed in chapter one. Responding to the three questions, this thesis seeks to contribute theoretically to the IS discipline and practically to the health domain, particularly in developing countries. The research questions (and answers) as summarized in figure 7 below will be expanded in the sections that follow. In providing answers to the three research questions, four sets of interplays were identified: i) between the modern and traditional health sectors; ii) between knowledge systems – local (indigenous) and scientific; iii) between social factions - those who afford to access health facilities and those who do not; and iv) between policy makers and citizens at community level. A discussion then follows on how these four interplays contribute to missing data and how they affect IS (HIS) data quality.

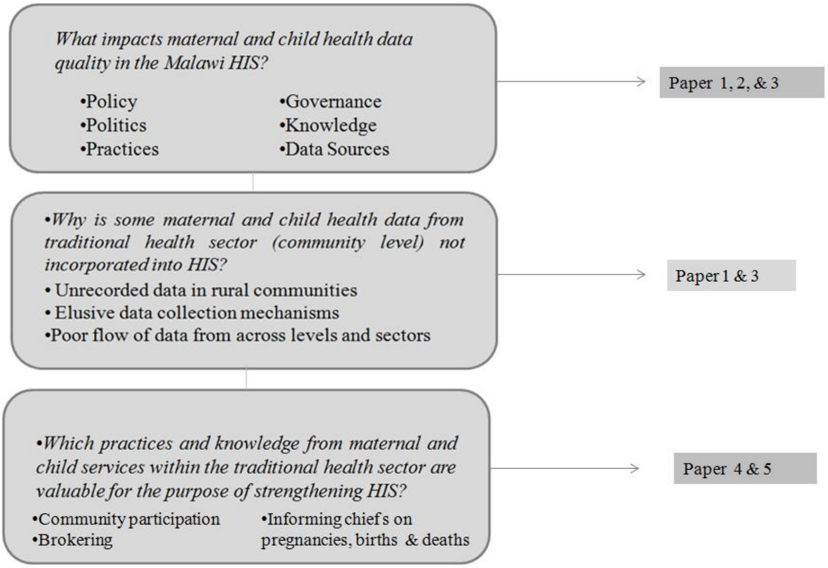

Figure 7 – The three research questions and answers and corresponding papers

6.1 The Missing Data Challenge in the Health Sector

While 'missing data' has been recognised as a common problem in the HMIS, most studies use statistical analysis (Norris, Ghali et al. 2000; Little and Rubin 2002). This research focuses was on how the missing data affects HIS through a qualitative and interpretive analysis.

The issue of missing data remains a challenge and raises many questions. Much as it is inevitable to have missing data, it helps to have effective explanations on why, how, where and which data is missing (AF4Q 2012). In developed countries, missing data explanations help understand the discrepancies in quality and how the data quality can be improved. Lack of such explanations may put the health providers at a disadvantage as clients want to have complete details. Developing countries lack the culture of record keeping by health providers and clients demanding for details. Hence healthcare providers (particularly in the traditional sector) do not feel obligated to record data.

I have defined missing data as data which has not been collected or been lost after collection and does not find its way into the formal HIS. The challenge is that the context studied has two different sectors with different practices. While the modern health sector records patient history in health passports and health facility registers, similar mechanisms are not available within the traditional health sector. Data for babies born within the traditional health sector remains invisible unless the birth is recorded by a HSA or the baby goes to a health facility for vaccination (Cf. Paper I). Despite having mechanisms for recording data, the quality, performance of the health workforce (Hongoro and McPake 2004), staff shortages and work overloads (Kadzandira and Chilowa 2001; Kaboru, Falkenberg et al. 2006) pose significant challenges for data collection in the modern health sector. Data quality is consequently haphazard.

Further, the existence of different administrative levels and health sectors require appropriate data sharing provisions. The nature, politics, and role of these data sharing mechanisms matter and they also contribute to data loss if not properly handled. Data sharing mechanisms are required to be strengthened between the community and health facility level, health facility and district level, and district and MoH headquarters level. Tsing (2005) describes this type of sharing as the ‘flow’ and prompts us to think of not only the flow, but also the channel that makes the flow possible. The potential of channels that makes flows possible is relevant to the analysis of data sharing across administrative levels and sectors. In this thesis, this is expressed through the idea of CoPs and the connectors that enable data sharing across CoPs. Tsing (2005) further points to the friction that exist in the channels. In this thesis, the channels are portrayed as links between CoPs, and where there is more friction or restriction of flow, this is expressed as a weak link. Drawing from the empirical data, the following findings related to the missing data are summarized:

i. Not all data generated within both modern and traditional health sector are recorded. Capturing data does not only depend on availability of data capturing tools such as modern technologies, it also depends on the one responsible for capturing (whether they value keeping records, how busy one is etc.).

ii. The empirical data points to the fact that there are more people in rural areas, yet more reform initiatives involving ICTs and structured data collection mechanisms are available in the urban areas.

iii. Restricting usage of health passport to the modern health sector, limits the way data from traditional health sector is collected. This is true for those who utilize the traditional health sector.

6.2 Determinants Affecting HIS Data Quality

In response to the first question, this research has highlighted that factors influencing HIS data quality can be deep-rooted with multiple underlying causes which vary depending on the context. Other than shortage of resources, health personnel, infrastructure (Kadzandira and Chilowa 2001), and elusive data collection mechanisms (Chaulagai, Moyo et al. 2005; Galimoto 2007), there are other factors that cause data to be missed and affect HIS data quality. These include: policies, politics, governance, practices within the different sectors, differences in knowledge types utilised, and the sources of data used as denominator within the health sector.

What impacts maternal and child health data quality in the Malawi HIS?

- Policy
- Politics
- Practices
- Governance
- Knowledge
- Data Sources

Other than being multiple, the elements that affect HIS data quality are both internal and external to the health sector. Some of the factors influence each other. For example, there is interplay between politics, governance and policy as explained below.

Policy, Politics and Governance - *policy* as a factor involves broad changes in the global policy environment and the relationships with international agencies and donors. In 1994, 179

Governments made promises to achieving universal access to sexual and reproductive health services (SRH) (Haarbrink 2009). However, SRH care was not an integral part of policies and funding aimed at strengthening health systems. Therefore, there was a mismatch between the promises and practices made by governments and donors. As a result, SRH has deteriorated due to inadequate funding and lack of prioritization (Haarbrink 2009). Other than an inadequacy at global level, also at the country level, capacity and political will is not guaranteed. Policies on strengthening both HIS and health care have been constituted globally, missing the local needs and situation on the ground.

This research attests that policy can have a huge impact on data quality. Examining how SRHR policy was implemented, it was found that it caused data to be lost when TBAs went underground and stopped recording data. This confirms that it is not just about increasing funding or making the programmes more gender-sensitive; but to also strengthen the political will to have the voice and needs of the women themselves addressed in policies. In the area studied, the SRHR policy focus is to achieve the MDG goals. However, the MDGs at the local level cannot be achieved without pregnant women having alternatives to TBAs. Therefore, much as the policies fulfill the global health goals, as Milio (1988) articulates, they fail to improve the local situation.

Although the need for information systems is felt in most developing countries, one mistake that donor agencies, policy and decision makers, and system designers tend to make is that, they often assume policies and information system architectures designed for one context are appropriate and can easily fit into other environments. Because of that, they proceed with implementation without doing a situation analysis to find out the local needs that can be added and local knowledge that can be utilised. However, considering the differing cultural, organizational and environmental factors, it is essential to research into these areas to design policies and systems pertaining to local needs. Because without an adequate understanding of some of these fundamental issues, it is impossible to design and implement policies and systems to meet those needs.

Locally, staff members from health facility and community level hardly participate when new policies are being introduced; yet they are supposed to own and implement the policies. Instead of the SRHR policy improving MDG indicators, its implementation arguably has slowed down the way data is captured.

Politics relates to issues where policies are constituted globally and represent politics of conflicting global and local interests. This is also evident between the central and peripheral levels in Malawi where the policies constituted at the Ministry of Health level conflicts with the needs on the ground. The politics of power (governmental) interplays with politics of poverty within communities. In politics, groups of people are supposed to make collective decisions (Sartori 1973). Empirical evidence however, indicate that it is 'those with power' taking an upper hand because most people in the rural areas live in poverty. Nacer (2010) described this as the politics of oppression and repression. Where different health sectors exist, the socio-political interests in the two sectors are different. The grass root people are on the receiving end to implement policies and plans which they may not be in agreement with. They receive whatever comes with the hope that it might improve their lives, e.g. the politics of the changing TBA role. This is more pronounced when it comes to women as they are marginalised (Osborne 1995; Barney 2007).

Using the feminist discourse lens, the realities of a patriarchal society where men are superior to women also increase the social barriers for pregnant women. For example, there is empirical evidence that in Malawi, some pregnant women do not even have a choice to decide where to have their babies delivered. The decision is made by their husbands (Seljeskog, Sundby et al. 2006). Their knowledge [and capability] is 'devalued and suppressed' (Barney 2007). Further, most women in rural areas depend on their husbands' income, and denied care in the health facility, the woman is left with no choice but to utilise a TBA. As Haraway (1988) articulates, the women do not have a 'finite point of view'.

However, all is not lost; by participating in the village committee CoP, the voice of the women is valued, no longer suppressed, and their point of view shared within and across CoPs through brokers. The village committee help the brokers, in this case, the HSAs, to have a voice because politically – on their own, they do not have the required clout. The value of CoPs helps resolve such a paradox as "a relational understanding of knowledge at a boundary also specifies at a very concrete level the relationship between knowledge and power" (Carlile 2004) p. 565). Empirically, the HSAs belong to more than one CoP and are able to act as brokers across communities. Within the CoPs which they belong to, there are different levels of power existing amongst members. For example, in the village committee, chiefs have more power than all other members, yet they interact and share concerns consensually with other members.

Governance issues play a role on both politics and policy making (Hajer and Wagenaar 2003). One of the strategies adopted by the Malawi health sector reform is decentralization, which in vernacular is referred to as "*mphamvu ku wanthu*" (power to the people). Despite the decentralization efforts, the communities still do not have the much desired clout when it comes to data and knowledge which they generate. However, at the community level, each village has some form of governing rules whereby for each birth or death occurring in a village, a chief is informed. Introduction of the village committee in the study area gives the group the mandate to follow up on the progress of pregnant women in their respective villages; charge *chindapusa* when a pregnant woman fails to have institutional delivery. Although the village committee is good at doing such follow ups on both the pregnant women progress and ensuring that the *chindapusa* is paid; they have some limitations as a group; i) They do not have proper mechanisms to ensure that all births (and deaths) occurring outside health facilities are recorded. ii) They do not have any rules in cases where a person fails to pay *chindapusa.* These two limitations confirm Wenger's argument (Hulsebosch 2010) that an organisational process problem can not be solved with a community of practice. Wenger et al. (2002) express that legitimacy and importance of the CoP is compromised if a community becomes too large. Here we extend the factors that may lead to a CoP failing to assert their legitimacy – when the village committee fails to act on or solve their limitations.

Knowledge – The modern health sector mostly uses scientific knowledge and the traditional health sector uses indigenous knowledge. These differences therefore impede sharing of knowledge and data across the boundaries of the two sectors. Once the knowledge and data generated is locked-in within one sector, the data for the health sector as a whole is compromised. This requires integration between the indigenous and scientific knowledge systems (Dekens 2007) and work towards building stronger links to curb the divide and disparity. CoPs utilise boundary connectors which allow for interactions and objects to be shared. This allows the *village committee* CoP for example, to intertwine the knowledge they generate with other CoPs in the modern health sector through the HSAs.

Agrawal (1995) suggests that participatory processes in which indigenous knowledge is shown to have value can help to enhance integration. On the other hand, Carlile (2004) warns of misrepresentations that may happen across boundaries and calls for translation of knowledge before it is shared. It is therefore important to know how to manage and utilize the knowledge once it is integrated. Within the health sector, HSAs assume the role of managing and translating the knowledge from the traditional to the modern health sector. For example, as HSAs compare the dynamics of the villages which they serve in their meetings, knowledge generated within the communities finds its way into the health facilities. Village committee members use practices and principles for managing their interaction with the environment that are different from those used in the modern health sector; for example, the practice of reporting births to the chief.

What one knows is not all that there is to know; therefore it is important to know who knows what so that all the relevant knowledge can be identified and integrated. Dekens (2007) has developed a framework for use within disaster preparedness that enables the integration of indigenous and scientific knowledge. It helps to identify the linkages and relationships between local knowledge and practices and enables an analysis of how the local knowledge can be used to reduce disaster risk (Dekens 2007; Mercer, Dominey-Howes et al. 2007). Deken's framework can be adopted to be used in the health sector by analysing how local knowledge can be integrated with scientific knowledge and used to ensure that MCH data is not lost. This emphasizes that within the health sector context, including both formal and informal institutions, have a role in shaping the knowledge generated and with it the data quality.

This research also highlights that a dynamic situation exists in the rural communities. In some cases, "indigenous communities have already integrated indigenous and scientific knowledge" (Agrawal 1995) where others lag behind, For example, trained TBAs, HSAs, and other individuals combine aspects of the traditionality with aspects of modernity, allowing for the local knowledge utilised to have both tacit and explicit aspects. This is paramount as it ensures that even the knowledge generated from marginalised groups like women (TBAs) is integrated into HMIS.

Like in the case in Dekens (2007), where some elements of natural hazards were considered as beneficial within a community; the local community members in this research also viewed birth at a TBA as being beneficial in some cases. For example, they would argue that pregnant women found it easier to be assisted by a TBA during delivery because they would either walk to the nearest TBA or the TBA would come to their homes and assist them Cf. (Seljeskog, Sundby et al. 2006). It is therefore necessary to initiate community engagement which can be done through the village committee and determine whether what the community would like to have as a solution is in line with possibilities offered. The village committee members in one of the areas studied came up with points during their meetings which they wanted to relay to the safe-motherhood and TBA coordinator at the district health office. To ensure that they get a chance to have an audience with the coordinator, they invited the coordinator to be their guest of honour during their annual general meeting/celebration where they had special events like dances and drama.

Data Sources - Since most of the population in Malawi live in rural areas, traditional health practices are inevitable. It is therefore prudent to have well structured mechanisms for capturing data at the point where it is generated, within the rural communities. However, currently, proper data collection mechanisms are lacking and there is no community-based HIS. As a result, some data from the traditional health sector are missed without being captured. Government's way of ensuring that data from rural communities is also included is by using census figures as denominator values for analysing indicators. According to Porter (1995), numbers are not always consistent with our premises. In the case of Malawi, as discussed earlier, there is no accurate figure for population per village or per health catchment area. Therefore the projected figures for these areas may be inaccurate making it difficult to trust in those numbers. It should also be noted that the census data is collected every 10 years, and population figures are expected to change over time. As an alternative, health facilities collect their own data to use as denominator values through *head counts*. The denominator value data is therefore collected from two sources; the census data and data from *head counts*. Accuracy depends on which data source is more accurate in the context (health catchment area). Most of the numerator values on the other hand, are collected routinely from the health facilities.

Empirical evidence shows that before the year 2010, most data collected from communities did not go beyond the health facility because this data is not included in the registers where data is aggregated. This explains the variation between the NSO percentages and those from this research. In 2010, new registers were introduced which included entries for data generated from the community level.

Practices – CoPs are an ideal forum for sharing practices (Wenger and Snyder 2000). It is observed that the different CoPs within the Malawi health sector have some practices that could benefit other CoPs and assist in solving the issue of missing data. For example, the current practice in the health facilities is to record patient transactions in a health passport as a way of retaining a patient's history. However, health passports are only used to record data at health facilities. The health passports are obtained from health facilities, as a result, only those who have utilized modern health services have them. Although health passports are located in the communities, they do not capture any data generated from the traditional health sector. Currently, health passports are the only existing example of HIS in communities.

Practices which take place within the village committee are also worth sharing. Not only do the members of the village committee create a practice-related social network; they also have 'collective action' (Brown and Duguid 2001; Roberts 2006). After engaging during meetings, selected members of the village committee go round to surrounding villages to implement what they agreed upon. For example, noting that their main goal is to encourage safe motherhood, they go round to educate pregnant women on the benefits of delivering at a health facility. They also try to offer solutions. Since most pregnant women point to long distances to the health facility as a limiting factor, the village committee sourced two bicycle ambulances to transport the pregnant women to health facility. This spirit of following ideas with action can be shared with other CoPs. The village committee also works out strategies for curbing practices amongst certain groups in the villages which are detrimental; like when some people refuse to have their babies delivered at a health facility due to religious beliefs.

Some practices were observed to have already spread across CoPs and health sectors. This is the practice of learning through songs as the boundary connectors. The songs help to improve the ability even of those "outside the network". In both the village committee and health profession CoPs, the songs are used as a tool for imparting knowledge to members of community and pregnant women attending the antenatal clinic respectively.

6.2.1 Interplay of Policy, Politics, Governance, and HIS

The study highlights issues of policy, politics, and governance domains influence on the way data for HIS is collected and transmitted (see Figure 8). These issues provide a useful perspective on the complexity of factors that influence data quality in an organization. However, much as some factors influence HIS directly, it is important to note that they also influence other factors. Some of the factors may not influence HIS directly, but have a strong influence on the factors that affect HIS.

Undeniably, most issues surrounding IS in developing countries are deeply intertwined with issues of politics, global policies, donor dependencies, and inequalities (Walsham and Sahay 2006). According to Sartori (1973), the notion of politics is inevitable; it applies to everything and has a causal supremacy to everything. Within health sectors, policy making is a political process; therefore, the way a policy performs will have an inference to politics. The conceptual model presented will help to build a contextual understanding of deep-rooted assumptions and causes of poor data quality in HIS context. In this case, the global pressure or requirements such as MDGs also play a huge role in shaping political interests and priorities. Decision makers therefore face a challenge in meeting global requirements, a pressure that outweighs the needs on the ground. The findings indicate that policies on strengthening both HIS and healthcare lead to a situation where policies may fulfill global health goals but fail to improve the local situation. We see a situation where globalisation and localization or decentralisation compromises each other. According to Reich (1995), policy reforms that benefit certain groups whilst ignoring others can elicit objection from those ignored.

The issue of governance comes in because performance of the health system is also dependent on the overall governance at local, national, and international levels. At all levels, governance is affected by different actors and the way these actors are able to voice their interests and act upon them. Whilst internationally and nationally the actions may be backed by policy documents, this does not apply at the local level like in villages. SRHR policy implementation was backed by a policy document at national level. However, this policy affected TBAs in a number of ways, one of them being that it meant that their source of income was stopped. Despite such strong reason, the governance structures do not have provision for ensuring their voices to be heard in the health sector.

Figure 8 illustrates the interplay of governance, policy, and politics with HIS. Governance strategies, processes, and practices can affect the performance of an organisation or a nation. Some policy objectives and the way the policy is implemented may also have unintended effects. Similarly, political interests and priorities may impact negatively on planned activities of an organisation. The quality of governance, policies and politics is therefore fundamental to executing organisational functions and these include information systems development.

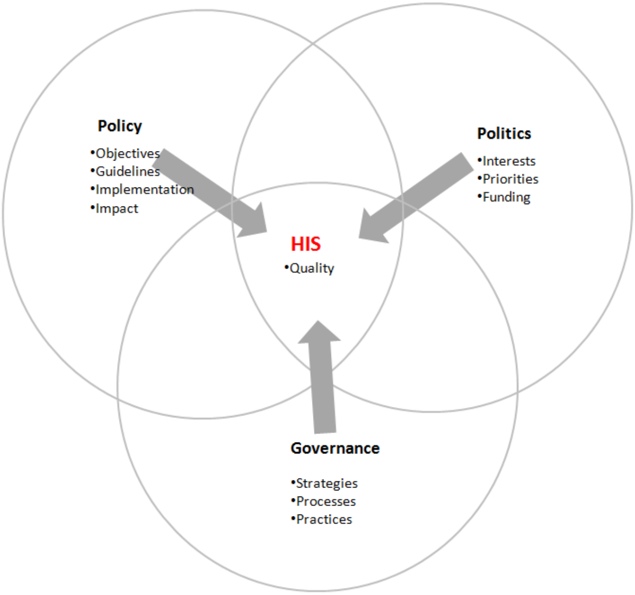

Figure 8– Conceptual model of factors that influence HIS data quality.

The multiplicity and interplay of factors influencing data quality emphasizes the fact that the context of implementation is influenced by both internal and external factors as discussed in *Papers 2 and 3*. In these two papers, trajectories of implementing SRHR policy where the national HIS was already existing were analyzed. SRHR policy was implemented in response to global call to have appropriate MDGs indicators. However, there were contradictions between MoH governance motives and the requirements and practicalities in the rural communities.

In this case, the dynamics of politics that informed the SRHR policy implementation affected HIS data quality negatively. Inadequately conceived or politically expedient policies can bring organizations down and cause public misery (Lindenberg 1989; Walt and Gilson 1994). For countries to come up with policies that are effective for their population, this study highlights the importance of global, national, and local bodies to work collaboratively and engage each other during policy formulation. This helps ensure that requirements at different levels are taken into consideration. At the institutional level, the health sector has different interest groups shaping the domain. These include WHO, donors, government, and the health sector levels. Currently, the interest of international bodies and higher administrative levels take an upper hand and data is collected to conform to their needs, making it difficult to retain the local needs.

Since the focus is on reporting to global players such as WHO, and donors, the data and information tend to flow upwards only (Kanjo, Moyo et al. 2009); hardly is feedback given back to the community level, where motivation towards HIS is limited. Ideally, data from private and public; modern and traditional health providers is supposed to be reported to DHOs, however, reality is different. Retaining local and national priorities while negotiating with international actors and global responses becomes a challenge. It is difficult therefore to have successful health reforms if the means for achieving them, such as data collection structures at the lowest level are not taken into consideration in the governance and politics of the health sector.

6.3 Bridging the Formal-Informal Gap

The second research question helps to address the gap existing where there is dualism of contexts. In the case of developing countries such as Malawi, Ethiopia, and India, this gap exists between the modern and traditional health sectors and it is bridged by a cadre of community health workers. Despite the dualism of formal and informal within the two health sectors, decision makers need to learn to work with both modern and traditional sectors recognizing that:

- *Why is some maternal and child health data from traditional health sector (community level) not incorporated into HIS?*
- Unrecorded data in rural communities
- Elusive data collection mechanisms
- Poor flow of data from across levels and sectors

> No matter how you divide up the developing world - 'formal-informal [modern-traditional]'… one thing is not debatable: most people are poor, on the outside of the system looking in, and getting angrier every day …it's time to stop talking and start designing reforms based on the informal practices … If you rebuild the system from the bottom-up, they will come, with their enterprise, creativity, … *Hernando de Soto, President, Institute for Liberty and Democracy, Peru.*

6.3.1 Modern and Traditional Landscape in the Health Sector and IS

Disregarding the context affects the data quality and IS success (Seddon, Staples et al. 1999; Lungo 2008). Here we have a situation with varying contexts in the two health sectors; the traditional health sector where people continue their old traditional ways of solving health problems, based on local practices and culture and the modern sector which uses modern methods and practices. The informal landscape (traditional context) lacks appropriate data collection and reporting structures and community based HIS. Further, the only available health personnel are the HSAs. This emphasize what Byrne (2004) found in the case of South Africa that the current HIS setup excludes those already marginalized. This leads to a situation where the HIS implemented is functional and usable, but produce poor quality data, hence compromising the usefulness of the HIS.

The traditional health sector maintains traditionality, something which is historical, yet remains relevant in the context, as it still is a favored solution to most of the population. This emphasizes the importance of not ignoring the social and contextual aspects of the environment where the IS is implemented. The modern-traditional landscape within the Malawi health sector poses some difficulties for HIS implementation with each sector having different data collection mechanisms and different rules.

The modern and traditional contexts also vary in the feminist ethics. Within the traditional sector, the patriarchal society plays a dominant role in the decision making process. The research therefore, highlights the need to move away from the notion that IS context can be handled as being the same in different environments, to one that recognizes the variations and dynamism in the context. For example, the environment where the HIS is implemented in developed countries is different from developing countries. Within developing countries, variations also exist between modern and traditional sectors, and all such variations need to be taken into consideration. Further, there is an emphasis on the need to move away from ISs that only considers functionality.

6.3.2 Utilization of Community Local Knowledge in Health Sector

To bridge the gap existing between the modern and traditional health sector, the role of HSAs as brokers need to be strengthened as discussed in *Paper 5*. Just as the knowledge displayed by people that are affected by disasters is ignored (Dekens 2007), knowledge generated by traditional providers and the role which the knowledge play in the health sector tends to be also ignored. Utilization of local knowledge promotes local participation. By utilizing local knowledge, it promotes participation of marginalized groups and improves bottom-up communication. Inclusion of all ensures that development is not asymmetrical amongst participants. Once development extends to the marginalized, the cyclic effect also promotes health. Avgerou (2008) explicates that it is difficult to create possibilities to improve conditions in a particular locality amidst the global socio-economic order. This is why marginalized need to be empowered and taken on board in developmental work. Local knowledge helps not only in understanding gaps or discrepancies, but also to understand underlying causes, so that appropriate actions can be taken.

6.4 Strengthening CoPs Links

A context in which a CoP is embedded determines its success in creating and transferring knowledge (Roberts 2006). Success of CoPs in the health sector benefits from knowledge and data generated in other CoPs, hence sharing is crucial for success. Theoretically, the study extends the CoP theory using the *weak link* concept. Practices, knowledge, and data are shared across the organizations through the boundary connections. In this thesis, a *link* is described as a boundary connection where two CoPs share practices, knowledge, and data through brokering, boundary objects or interactions. Although the CoP approach provides us with a means to describe transfer of knowledge in a social context (Roberts 2006), it is not as explicit on the strength of the connections. Where the boundary connection is intermittent, it represents a *weak link* across the CoPs. For example, after SRHR policy implementation, data generated at TBAs is not recorded and HSAs do not find ready data. Therefore, data sharing between community and health facility becomes a challenge.

In a health sector context, instances of CoPs within the different levels of a health sector are visualized as being linked. The CoPs are the nodes, and *boundary connections* are the links. Flow in this case is the sharing of practices, knowledge, and data from one CoP to another. Inclusion of the *weak link* concept emphasizes the need for the constellations of CoPs to have strong connections allowing for sharing.

HIS data quality can be improved if all CoPs (from both modern and traditional health sectors) share practices, knowledge, and data because the highest level in the health sector hierarchy depends on data that is generated and collected from the lower levels. Any discontinuation of any boundary *connection* will compromise the HIS success. Just like a chain of necklace made of beads; if one drops off, the necklace comes apart. A broken chain can be repaired, or better still, weak links of the chain can be strengthened before it falls apart.

> “Communities of practice are not self-contained entities. They develop in larger contexts – historical, social, cultural, institutional – with specific resources and constraints.” (Wenger 1998) p.79

Having strong links across CoPs emphasizes that sharing is achieved, not just between two CoPs, but spanning boundaries of several CoPs and "that practice is not just local but connected to broader constellations" (Wenger 1998) p. 162. For example, in the health sector community level practices are connected to the MoH level; HIS reports at MoH depend on data generated at community and health facility levels.

I portray the different instances of CoPs in the health sector as two sequences: the vertical and the horizontal, to be able to visualize the conduits carrying the boundary objects. The vertical sequence depicts a linear process involving instances of different CoPs at different levels of the health sector which are linked from community level (lowest level of the data source) to the MoH level where all HIS data is used to produce reports. The horizontal depicts a linear process linking instances of different CoPs at the district level, illustrating data flows from vertical programs, private clinics, NGOs to the district health officer. The main focus in this thesis is the vertical sequence, linking different health sector levels; at the same time, linking the traditional and modern health sectors as illustrated in figure 9.

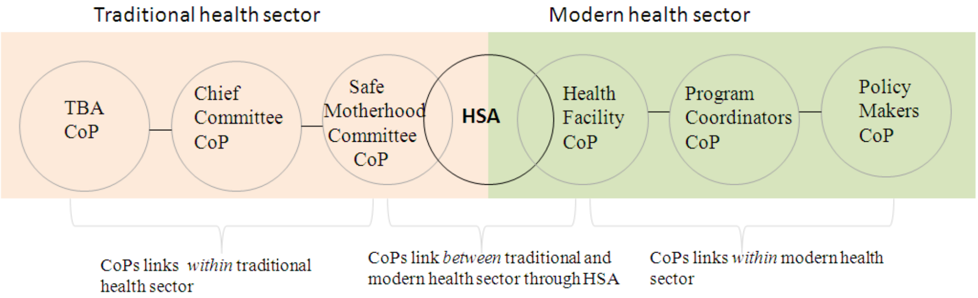

Figure 9 – HSA linking traditional and modern health sector

Figure 9 also illustrates the fact that a complete chain across the Malawi health sector comprises of a chain of CoPs within the traditional health sector linked to a chain of CoPs within the modern health sector. HSAs are the only link between the two sectors. Weak link may exist at any boundary connection within the chain of CoPs. For example, a weak link can exist between the *TBA* and *Chief Committee* CoPs if a pregnant woman being advised by a TBA do not give village chief details of her pregnancy and refuse to abide by the safe motherhood rules being reinforced by the chief due to beliefs. Currently, a weak link exists between traditional and modern health sector; although HSAs are doing a lot of what they are supposed to try and link the two sectors, they are not doing so in an effective manner. They fail to collect data from the community on a daily basis due to work overload, causing data generated in rural communities to be missed.

Just like an efficient flow of products relies upon links not becoming disjointed in a supply chain (Tsing 2005); the efficient flow of data and knowledge across the health sector relies on the links of CoPs not becoming weak.

In developing countries, weak links across CoPs may apply particularly where there is interplay of traditional and modern practices. The mode of communication in these contexts could be oral, hand written papers, electronic, or through brokers. The hand written papers and electronic messages are boundary objects; on the other hand, oral messages represent boundary interactions. Within the traditional health sector, only boundary interactions exist. In the modern health sector, both boundary objects and interactions are used. Where boundary interactions only are used, the links tend to be weak, therefore, CoPs that communicate using boundary interactions (orally) are considered as weak links.

This study's findings reveal the existence of the weak link between the modern and traditional health sector in terms of data flow. Labonte (2004) phrases what aggravates the weakest link in an ironic manner that 'how does one go about including individuals and groups in a set of structured social relationships [network] responsible for excluding them?' (Labonte 2004)p.3. The SRHR policy excludes the TBAs in the system yet at the same time the data that they generate is crucial to the success of HMIS.

6.5 Local Knowledge as Driver of HIS Data Quality

HIS in developing countries operate in a context where multiple factors both in the modern and traditional health sectors affect the quality of data produced. Some of the factors are intertwined, historical, institutional, and deeply embedded within the context. The study has provided clear rules and methods for handling missing data in HIS both within traditional and modern health sectors. The study also helps to understand how local knowledge is cultivated and utilized during participation. Edward (2010) warned against discounting local knowledge, in this research, we have highlighted the consequences of having local knowledge as background knowledge. The more people within communities participate, share experiences and knowledge; they build their capabilities and trust amongst their communities. These capabilities and trust enable them sharing benefits of capturing data generated locally, and devise their own sustainable means of ensuring that data is sent to health facilities. Improved data quality in HIS would lead to more precise data for planning and policy formulation. The process of utilizing and externalizing indigenous knowledge also helps empower people, an ingredient for development. With good quality data, more effective policies may result and the quality for indicators for attaining health-related MDGs (i.e. maternal mortality ratio) will potentially be improved.

The MDGs are measured by indicators which include reduction of maternal and child deaths, which at an international level are believed to be solutions for meeting MDGs targets if attained by the countries. Formulation of such global knowledge disregards the variations within the context where such knowledge is being used and ends up bringing tensions between the global and local. Therefore, we need a global network of connections and ability "to translate knowledge among very different – and power differentiated communities" (Haraway 1988) p. 580. This should apply locally within the health sector and country, and also globally.

The health domain is crucial to analyzing data quality in IS as it clearly illustrates that there are different dimensions within a context where IS is developed. For example, within the health domain there are different environments - modern and traditional. The thesis has therefore provided a theoretical framework and practical implications for understanding factors that affect data quality and the role of local knowledge in improving it. A number of factors have been identified as influencing data quality. Which is the driver? Local knowledge is crucial as it can guide on which factors to take into consideration under the existing circumstances.

Comparison of the Malawi case with Ethiopia and India emphasize the commonality of factors influencing IS data quality within a health sector and developing countries in general. In all three countries, the primary link between the modern and traditional health sectors are community health workers, who are overloaded with duties as a result, and data capturing within communities is given less priority. This makes the data flow link between the two sectors weak. Strengthening the link between the modern and traditional health sectors is in line with notion of narrowing the gap between formal and informal institutions (North 1990) to ensure success of change initiatives within an organization.

Other than health sector and Malawi, the concept of *weak link* across *CoPs* can be applied in other sectors and countries, both developed and developing. For example, situations where an idea is conceptualized and a design is produced but fails to be implemented indicate that there is a weak link between designers and implementers CoPs. Strengthening links across CoPs within any organization can enhance communication, learning, and sharing of practices and knowledge amongst its members. Knowledge is a key to success and organizations need to understand what it involves (Wenger, McDermott et al. 2002) and be in a position to share it across.

6.6 Theoretical and Practical Contributions

This thesis seeks to contribute theoretically to the IS discipline, specifically to HIS, and practically to the health domain, particularly in developing countries. The implications of this research therefore, are not specific to the Malawi context. They have broader repercussions to other developing countries health domain and other IS. The practical implications of this research also apply to both national and global levels.

6.6.1 Theoretical Contributions

My theoretical contributions focuses on how the different theoretical concepts used in this research impacts on IS/HIS data quality.

Integrating Local and Scientific Knowledge for Better Understanding of IS Context – The change from a focus on technology to context when developing IS necessitates the recognition of local knowledge and practices as the context is influenced by both local and scientific knowledge. In IS, the growing interest in local knowledge promotes a good understanding of the context. I therefore argue that knowledge of the context is one of the building blocks in IS development. Lack of knowledge is considered to be a symptom for poor data quality (Nyamtema 2010). Excluding one form of knowledge would imply compromising the needs of those utilising such knowledge. This research emphasizes the importance of including both local and scientific knowledge (Puri 2003). The empirical findings point to the fact that the local knowledge and practices aid in data generation and collection. I argue in this thesis that although local knowledge is ignored (Dekens 2007; Mercer, Dominey-Howes et al. 2007) and considered as unimportant, it helps to give a complete understanding of the context and why certain things like missing of data happen.

Enhancing Gender Ideologies to Improve Discursive Power within CoPs – Theorising gender is important in enhancing participation that results in having a balance from both male and female participants. Taking CoP perspective, I argue that there is need to ensure that as the members participate, the underrepresented and suppressed voices are heard. Although there has been research on gender, research addressing gender variable has been limited in scope and quantity within the Is domain (Adam 2001). This thesis contributes to the feminist discourse by extending participation in CoP to include gender ideologies so that discursive power is improved.

The use of feminist discourse and CoP concepts allows issues of power relations and marginalisation to be addressed and sheds light on the relevance of the ignored voice.

Enhancing Data Sharing through Strong Links across CoPs - The findings also provide a theoretical basis that combines the CoP theory with *weak link* concept. The combination is used to analyze the strength of relationships, connections that enable knowledge-sharing across CoPs, health sectors and administrative levels. It emphasizes the significance of strong linkages within the health sector across sectors and administrative levels. The data flowing into HIS will only be complete if there are no *weak links* between the different CoPs within the health sector hierarchy. A *link* being the crucial boundary connection where two CoPs share practices, knowledge, and data through brokering, boundary objects and interactions. As members participate in the CoPs, they get the opportunity to share wide range of issues – governance, politics, resource allocation, human behaviors, gender, and power; in the process, they shape the health domain knowledge and data and information flows.

The study highlights that issues of politics, policy, and governance have an influence on the way data for HIS is collected and transmitted. These issues provide a useful perspective on the complexity of the factors that influence data quality in an organization.

6.6.2 Practical Contributions

Practically, improved data quality in HIS would lead to more precise data for resource allocation, planning and policy formulation. The process of utilizing and externalizing indigenous knowledge also empowers the people, and enhances development. With good quality data, good policies may result and the quality for indicators for attaining health-related MDGs (i.e. maternal mortality ratio) will be improved. For countries to come up with policies that are effective to their population, this study highlights the importance of global, national, and local bodies to work collaboratively and engage with each other during policy formulation. This will help ensure that requirements at different levels are taken into consideration.

The study provides clear rules and methods for handling missing data in HIS both within traditional and modern health sectors using the knowledge and CoP concepts; this is in line with Krickeberg (2007) principle. Much as most of the CoP concepts and knowledge acquisition used in the research such as - generating expertise, experiential, practice based - do seem to relate to the traditional sector most, they also apply to a lesser degree in the modern health sector (such as informal practices amongst HSAs and other health professionals). Most importantly is the fact that the CoPs in both traditional and modern sector enhances governance, with members of the CoPs having “clear roles and expectations” (Serrat 2010).

Although the study uses the Malawi health sector as a case, the study emphasizes findings from India (Puri 2003). Like in Puri’s study, where aspects of indigenous knowledge which in most cases are considered as inferior to scientific knowledge are part of the health sector. This is more pronounced where there is duality (rich/poor, modern/tradition, urban/rural) where one side is seen to be more superior to the other (AF4Q 2012).

Whilst the intended effect was for TBAs to stop conducting deliveries and take on an advisory role; unintended effects were found (such as: continuing to conduct deliveries through consent of committee; continuing to conduct deliveries illegally and not recording the data; village chiefs benefiting from chindapusa). This has created a gap between policy and reality. What has been planned and reality on the ground is different. The SRHR policy has increased the number of missing babies within the communities as the trained TBAs stopped recording data although they still conduct deliveries, leading to loss of data at community level.

The thesis argues that promotion of deliveries at a health facility by skilled birth attendants alone will not improve the data quality because despite the safe motherhood campaigns, there is evidence of other factors that cause delivery by unskilled attendants. Improving data quality entails taking into account availability of health facilities and personnel, particularly in rural areas. There will also be the need for a policy framework for i) the general public that spell out the advantages of delivery by a skilled attendant, ii) TBAs that gives an alternative way of generating income, iii) Health professions attitude towards clients which also relates to workloads as the attitude they portray can encourage or discourage health facility deliveries, and iv) data sources. Until there is a shift in mindsets, pregnant women will continue

I conclude that traditionality needs to be taken into account in designing health information systems in Malawi and argue that a system which engages chiefs, exploiting and 'modernizing' their existing data gathering processes, may be the way forward. In line with the influx of mobile phone technology, the chiefs and HSAs can also be empowered with mobile phones to ease transfer of data between community and health facility levels.

6.7 Recommendations for a More Pragmatic Approach

In Malawi, as in Ethiopia and India and other developing countries, it is not possible to change the modern-traditional dualism affecting health sectors since most of the population still depend on traditional providers. However, this thesis has identified the multiplicity and complexity of factors influencing HIS data quality. This gives a good starting point for improving HIS data quality; underlying causes have to be tackled without which the problem will continue to recur.

Considering there is modern-traditional dualism in developing countries health sector, and that a large proportion of the population utilizes the traditional sector, it is essential to come up with a more pragmatic approach that encompasses both sectors. Knowledge and practices generated in the traditional sector need to be taken on board to assist in capturing data generated in that sector. Undermining knowledge and practices from traditional sector would jeopardize the success of HIS as most data would remain excluded thereby compromising HIS data quality.

Practically, the research emphasize that structured methods of capturing data be implemented at community level in the developing country context in order to improve data quality. To improve the data capturing processes in the traditional sector, there is a need to utilize existing structures and enhance existing practices that help in data capturing instead of re-inventing the wheel. A practice where a chief is informed of each birth or death in a village can be enhanced and have each chief assign a responsible person from their village to capture that data. The existing village health registers can be utilised for this purpose. This would re-institutionalize the practices in the colonial period when a wide range of administrative data, some of the data was related to health; such as births and deaths were collected by chiefs (Vail and White 1975). The data can then be collected on a monthly basis by HSAs.

To ensure that all births are captured both routinely and through surveys, collaboration between modern and traditional sectors can be instituted that allows the births taking place out of health facility (at home or TBA) to be recorded in a health passport by a chief. The modern and traditional collaboration can also be extended to allow TBAs work collaboratively with health professionals in situations where an emergency case is referred from TBA to health facility. This can empower the TBAs and encourage them to refer complicated cases (see table 7) without fear, and it will also ensure that data is not lost.

HSAs should be given hard note books to use for capturing data instead of the loose forms or thin note books which they currently use. The hard note books can also have pre-formatted tables to ensure consistency in what is being collected by all HSAs. Most importantly, the format should be simple enough to follow without any training and not complex as the village health registers. Village health registers are hardly used due to their complex nature.

This research has also underlined that politics, policy, governance, and public organizations such as health sector, are intertwined in developing countries. Health sector being a public organization is also intertwined with government politics. Politically, consensus has remained a top-down notion where decisions are made at the top and subordinate levels are simply instructed on what to implement. This has manifested in health sectors as well. The politics and governance surrounding health sector should weigh practicality of policies and strategies being put forward for implementation. It is not always the case that the implementation plans will address or respond to the problems within communities. For example, it is politically correct for all pregnant women to have their babies delivered at a health facility; however, reality is that the health facilities offering maternal services are not enough for all or within every pregnant woman’s reach.

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Rules, Reality and Results: Inter-Institutional Coordination and Impact on Health Information Systems in Developing Countries

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Abstract

In the health organisation field, weak or lack of coordination between different players leads to inefficiency in the whole health information system. The Malawi health sector is no exception. It has a plurality of health service providers, as is the case in most low income countries, and these providers are separated into the traditional and modern sectors (ADF, 2005). The traditional health providers are considered as the informal health providers.

This paper aims to identify the extent which the informal and formal health providers coordinate and how much information from the informal health providers, with specific focus on the traditional birth attendants, is integrated into the health management information system (HMIS). This will take into consideration the existing rules in the health care system and the reality on the ground in the rural areas. While the existing rules ban the operations of traditional birth attendants (TBAs), the masses see the TBAs as being responsive to their needs. This results in weak links in the HMIS as some information which could have been captured from the TBAs end up being missed as they fear to report data due to the set rules.

1 Introduction and Aim

1.1 Introduction

In Malawi most initiatives in the health care system are driven by rules. Often these rules do not fit the reality on the ground. The mismatch between the rules and reality makes it difficult to design, develop and implement health information systems that conform to the situation on the ground. The Ministry of Health in Malawi have two departments that deal with the health care system these are the Planning and Preventive departments. Within the health care system, there are different programmes such as HIV and AIDS; Expanded Programme on Immunization; Safe Motherhood; Maternal and Child Health, Malaria and others. Over the years, the Malawi health sector has come up with a number of initiatives including the development of a health management information system (HMIS). HMIS caters for all programmes and it is currently in the Planning department. The HMIS' primary goal is to collect, analyse, report, monitor and evaluate the routine data from all health providers in Malawi. However, the Malawi health care system landscape poses a big challenge to achieving the HMIS goal (Kanjo et al., 2009). The Malawi health care system has a number of institutions that include both public and private health organisations from both rural and urban areas. A public health service in this context refers to health care institutions belonging to the state while the term private is meant to cover all other configurations (Giusti et al., 2007). Whilst the public and private health providers are considered to be formal, in Malawi, as in most of Sub-Saharan Africa, there are other informal health service providers and these include traditional birth attendants (TBA) and traditional healers. The TBAs act as midwives in their communities. Some of the TBAs have established links with the modern health sector as they have been trained to support primary health care. In January 2007, the role of the TBAs changed from delivering babies to advise and motivate mothers to appreciate the need to go for skilled attendants at health facilities. According to Ministry of Health (MoH) report (2001), they deliver approximately 25 percent of the pregnant women.These informal health service providers also influence the health services data and institutionalisation of health services in general. Whilst it is uncomplicated to capture data from and apply rules to urban areas and formal health providers; the rural areas and informal health providers pose a challenge as the reality on the ground may not always correspond with the set rules. As a result there are some weak points and gaps in the process of collecting HMIS data from the rural areas and informal health providers in particular.

1.2 Aim

Whilst it is known that the official figures vary (Cf. DHS, 2004; Munthali, 2007; MICS-NSO, 2007; WHO, 2008); that there are problems with infrastructure and systematics in rural areas (Munthali, 2007; Bowie et al., 2006); and that not all babies are delivered in a health facility (DHS, 2004), we do not know the extent of missing data as a result of babies being delivered outside the system that gathers this data. The aim of this paper is to identify the extent to which information from the informal health providers, with specific focus on the traditional birth attendants, is integrated into the HMIS[1]. This will take into consideration the existing rules in the health care system and the reality on the ground in the rural areas. Further, the paper aims to identify why some information is lost as a result of the existing rules.

The chain theory is used as an analytical lens to identify the weak points and the gaps in the data collecting process and the impact of these weak points in the HMIS. The paper also analyses the rationality of following set rules even when they do not ‘fit their purpose’ using concepts drawn from management and organisation theories.

2 Theoretical Framework

Chain theory is mostly used in Mathematics. Although it was proposed as early as the 1850s, it was largely initiated in the 1950s by Harris and was used as a method to explore how a distribution is constructed within a system/process (Gilks and Spiegelhalter, 1996; Asmussen, 2003). A chain is made up of several links and its strength depends on the weakest link. Within an organisation, an organisation system can only be efficient if all sub-systems are performing efficiently. Like a chain, the most unreliable sub-system can cause the whole system to fail. Goldratt (1997) observes that in projects different people perform different tasks and some tasks depend on subtasks. In this process, the slowest stage tends to be a constraint to the whole project and there is need to ensure that both the critical and noncritical paths are carefully implemented and monitored to avoid problems brewing in a noncritical

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[1] This paper does not look at information/figures from the private sector, but concentrates on the public sector from community level.

path (ibid.). The problematic areas may end up being the weak points in the process and cause delays in the whole project (Goldratt, 1997). Goldratt defines a project as “a complex initiative that in order to manage it, people have to draw the picture of what they are supposed to do" (ibid. p.10) and in most cases people fail to come up with a realistic picture. In addition, all organisations have rules both formal and informal (Clegg et al., 2005) and some form of administration as defined in Max Weber’s fifteen dimensions of bureaucracy (ibid. p.51-52). Weber clearly articulates the relationship between the different positions within an organisation hierarchy and the power relations that exist.

In cases where organisational rules are put in place without apposite situation analysis, unintended effects may result. Behrens and Sedera (2004) in their study investigate why shadow systems[2] exist and remain wanted by the public even when they are deemed to be illegitimate. The gap between the requirements of stakeholders and the organisational implementation strategy may lead to the existence of shadow systems within an organisation (Behrens and Sedera, 2004). The gap is influenced by both causal and intervening conditions which include organisation processes, technology, people factors, the resources and support available (ibid.).

2.1 Paradox of Rules

Although rules are set within an organisation, “they are often broken in order to compromise with reality on the ground for better results” (Clegg et al., 2005: p84). The irony is that rules are obeyed not because of the person giving them but due to belief that the person giving the rules is acting in accordance with the demands of the office. The rules have a lot of influence on power relations within an organisation as power also belongs to an office not the office holder (ibid. pg, 51).

2.2 Organisational Rules, Organisational Learning and Information Systems Development

“Organisation rules mean different things to different people in different contexts at different times” (Clegg et al, 2005). It is how these rules are used that determines peoples’ interpretation of the rules, their reaction (ibid.) and the experience that can be gained and learnt from that. While acknowledging that it is not always clear what organisations can learn from experience, Lyytinen and Robey (1999) conclude that over the years some organisations are failing to learn from their own experiences and end up learning how to fail (Lyytinen and Robey, 1999, p. 86) as they ‘misplace their attention of what and how they should learn’ from both external and internal sources (ibid.). Heeks (2003; 2006) attributes failure of information system projects to design-reality gaps. Advancing technical solutions is not enough to address failure, measures that take into consideration the complexity and heterogeneity of the situation on the ground need to be put in place (Heeks, 2003; Lyytinen and Robey, 1999).

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[2] Shadow systems are defined as systems which replicate in full or in part data and/or functionality of the legitimate systems of the organization (Behrens and Sedera, 2004).

3 Research Approach

3.1 Context

This case study is based on Health Management Information System development for the Malawi health care system. Malawi is a small, land locked country, in the southern part of Africa bordering Tanzania on the north and northeast, Mozambique on the east, south and southwest and Zambia on the west and northwest. Malawi is an agricultural economy and 87% of the population live in rural areas (NSO- MPHC, 1998). The study was conducted in Zomba, one of the districts in the southern part of Malawi. Zomba district was chosen as it has all the different types of health facilities (Public, Private, Christian, NGOs, Institution owned and TBAs).

The health care system in Malawi follows *the inverse care law*[3] and is pro-rich (Zere et al., 2007, p.2). Assessing the trends in inequities, Zere et al. established an increase in child deliveries at home and a decrease in immunization coverage between 1992 and 2004, reporting a decrease of 17% (ibid. p. 10-12; Bowie et al., 2006; Munthali, 2007). The health care system is also hampered by a shortage of medical staff, drugs and diagnostic resources. Further, Malawi has extreme poverty and high human immunodeficiency virus (HIV) prevalence (Daza et al., 2006). The shortage of medical staff led to programs that support the informal health service providers such as the traditional birth attendants (TBA). In Malawi, United Nations Population Fund (UNFPA) has supported TBAs programmes since 1970. In 1987 the Safe Motherhood Initiative was introduced. The TBA programme was strengthened further in 1990 when UNFPA, WHO and UNICEF issued a joint statement (UNFPA, 1996).

3.2 Methodology and Methods

The study used interviews, participant observation, document analysis and informal talks[4] and discussions with both interviewees and others who were present during the interview sessions[5]. Combining the different methods facilitated in identifying at which level and why information was lost and the gaps existing in the process of collecting HMIS data. Both authors were directly involved in the interviews and had a chance of playing the role of participant observers as the interviews were conducted at the place of work of the interviewees.

Eleven in-depth interviews were conducted with members of the health care system during the period January to March 2009. These included one member at the Ministry level; 4 members at district administrative level; 2 members at healthy facility level; and four traditional births attendants at community level. At Ministry level, one Director from the Planning Department was interviewed. At district level three programme coordinators (TBA coordinator, EPI coordinator, HMIS coordinator) and the Assistant Statistician were interviewed. Each interview lasted about 45 minutes. In each case an interview guide was used. The EPI coordinator was interviewed three times. At a health facility level, the Officer in Charge and one Health Surveillance Assistant were interviewed. At community level, four TBAs were interviewed (three trained and one untrained). The names and locations of the TBAs were obtained from

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[3] The Inverse care law is "the principle that the availability of good medical or social care tends to vary inversely with the need of the population served" (Hart, 1971).

[4] Informal talks are additional questions and answers which were not part of the planned interview.

[5] Relatives or other members of the community would be present during interviews with TBAs.

the TBA coordinator at district level and the health facilities. For the three trained TBAs, each interview took more than one hour.

Participant observation was used to get a complete picture of the situation. This proved to be useful particularly at health facility and community level. A good impression of what was unsaid was collected in addition to the responses given during the interviews. Further, the informal talks after the interviews proved to be a good source of information too.

3.3 Ethical Consideration

Before commencement of the study, the research proposal was cleared by the PhD Board for the Faculty of Science at University of Oslo and College of Medicine Research and Ethics Committee (COMREC) of Malawi for final approval. Permission to collect data at the study site was also sought from the District Health Officer (DHO) of Zomba district. Once clearance from COMREC was given, the letters from COMREC and DHO were be used to ask for permission from the Chiefs in the study area and the TBAs. Further, all participants were only interviewed after giving their consent.

3.4 Limitations

Because TBAs are not allowed to undertake deliveries, it is anticipated that there may be difficulties in gathering the exact number of informal deliveries at which some TBAs, with the exception of those with support from their chiefs or locality, have helped.

4 Findings

HMIS has a complicated history. At first it was in the Planning department, then it was moved to the Preventive department, and now it is back in Planning.

4.1 Data Flow

Data flows from community level to the headquarters. At community level, data is collected by health surveillance assistants (HSA). Each HSA is responsible for several villages within a catchment area. The HSAs collect health related data from traditional births attendants (TBA) and village chiefs. Prior to the TBA ban, HSAs used to collect data relating to pregnant women and births from TBA report books and birth registers (see section 4.3.3) within communities on a monthly basis. Each HSA would record the total number of births assisted by each TBA and the number of pregnant women attending antenal care at that particular TBA. The data would then be reported to the TBA coordinator and the nearest health facility. The officer in charge of each health facility compiles data on a quarterly basis and submits the reports to the HMIS statistician at the district health office (DHO). The HMIS statistician would then compile the quarterly reports from all health facilities within the district and submit to the HMIS office at the Ministry of Health Headquarters.

In a parallel system, the coordinators for the Expanded Programme on Immunization (EPI), Martenal and Child Health (MCH), Safe Motherhood & Traditional Birth Attendants (TBA) at the DHO would collect data relating to immunization coverage, maternal health, and births from the officer in charge at each health facility on a monthly basis. After compilation, this data is sent to the EPI Unit.

Data from all health facilities is collected on loose forms; some of these forms are collected by the coordinators from the health facilities. In some cases, the officers in charge from health facilities deliver these forms to the coordinators at the district health office. (*An observation was made where the officer in charge did not find the responsible coordinator and left the filled form in another office*).

4.2 Rule

Since 2007, the Malawi Ministry of Health changed its policy on the role of TBAs. TBAs are not allowed to conduct deliveries; instead they are advised to refer the pregnant women to deliver at the health facilities. The role of the TBA now is to motivate pregnant women to appreciate and understand the need to go for skilled attendants at health facilities.

In terms of reporting, the health care system has different types of reporting systems. HMIS reports on quarterly basis, Expanded Programme on Immunization (EPI) reports on a monthly basis and Integrated Disease Surveillance and Response (IDSR henceforth) get reports on weekly basis. EPI programme introduced a policy that immunisation vials should be opened even for one child.

4.3 Reality

The Planning and Preventive departments hardly exchange data, although in some cases a single programme may belong to both departments. For example, IDSR which belongs to the Preventive department has the Malaria programme and HMIS has a Malaria program too. It was reported that the data for Malaria programme from the two departments do not tally. IDSR was supported by the World Health Organisation (WHO) and within the districts they are well equipped with resources such as computers, motorbikes, and generators. Despite the fact that IDSR is a subsystem of HMIS, the HMIS personnel have lesser resources than those in IDSR.

Most health facilities in Zomba district have at most 2 nurses.

"*A few lucky ones may have 3 nurses*" (TBA Coordinator).

Further, the infrastructure where pregnant women can wait for deliveries at most health facilities is a challenge.

"*There has been about 70% increase in deliveries against 3 nurses. … Some are delivering underground*" (Officer in Charge of a Health Center).

Prior to the change of policy on the role of TBAs, Zomba district had 80 registered trained TBAs who used to report deliveries to the TBA coordinators office. After TBAs role changed from conducting deliveries to advising pregnant women to deliver at health facilities, only 2 TBAs still give reports. All trained TBAs had registers where they used to record the babies they used to deliver. In addition, they used to have report books for those attending antenatal care at the TBA. This was evident for all three trained TBAs who were interviewed. All three reported that they started as untrained TBAs based on experiential knowledge. One TBA learnt from her mother, while the others were self taught based on need within their communities. One of the TBAs pointed out that the problem was that pregnant women wait for labor to start before going to the healthy facility even when they live very far from a health facility. One of the TBAs had clients from 22 surrounding villages, and before the change of policy, she used to report up to a maximum of 50 births per month.

"*Now I assist in delivering less than 10 babies per month.*"

The reality is that pregnant women still deliver their babies at TBAs or at home as a matter of choice. This confirms the results of a study that was conducted in Mangochi district where pregnant women found it easier to be assisted by a TBA during delivery as they would either just walk to the nearest TBA or the TBA would come and assist them at their homes (Chimango et al., 2008).

4.3.1 Births at TBAs

There are a number of factors that influence the three places of delivery mentioned above. Pregnant women still go to TBAs due to the long distances between their homes and a healthy facility. But due to change of role, TBAs turn them down and advise them to deliver at a health facility. When asked if the TBA who lives closer to the health facility go to assist deliver babies at the health facility she had this to say:

TBA1: "*Why should I assist for nothing when they have terminated my job*"… "*They stopped us from delivering babies completely and they even threatened that who ever is found delivering babies will be jailed*"

TBA2: *"It was found that most pregnant women would deliver babies on the way to health facility since this place is very far from Pirimiti [nearest health facility] and time and again I would be called to assist at the road side. At times, whilst assisting one, I would also learn of another, who would also have delivered on the way and gone back home."*

TBA3: "*I no longer record the births after the ban.*"

4.3.2 Mothers assisted by TBAS

The mothers assisted by the TBAs were categorised into several groups: (i) easy ones without any complications; (ii) those who were HIV positive; (iii) those with complications ranging from haemorrage, those who had premature baby before, breach cases, and awkward baby position. Mothers belonging to groups (ii) and (iii) were the ones referred to the health facility both before and after the barn. An exception was that out of the three trained TBAs that were interviewed, one would also refer to the health facility mothers delivering for the first time.

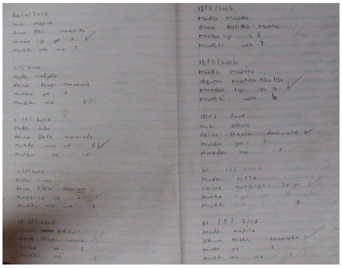
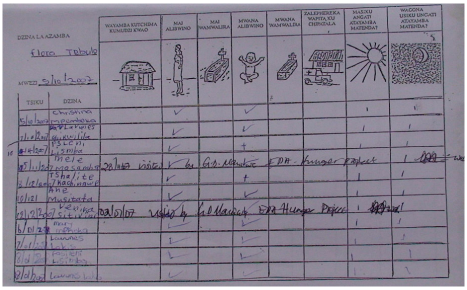


Figure 1 TBA Report Book

4.3.3 Information recorded by the TBAs

Each of the three trained TBAs had a report book (see figure 1) for pregnant women attending antenatal. In the report book, they would record the following details: date of antenal visit, village where mother comes from, name of the pregnant woman, number of months for the pregnancy, and number of previous pregnancies the woman has had.

In addition, the trained TBAs had birth registers (see figure 2) where they would record birth details. The information on the birth register include: the name of the TBA, the date when she started recording on the sheet, date when each mother recorded on the sheet was delivered, name of mother, whether advanced labor stage reached before arriving at the TBAs place, mother and child's condition after delivery, whether mother or child is dies in the process or whilst at the TBA, whether mother is referred to the health facility, number of days since labor started, and number of days admitted at the TBAs place.



DZINA LA AZAMBA Flora Tebulo

MWEZI 5/10/2007

TSIKU	DZINA	WAYAMBA KUTCHIMA KUMUDZI KWAO	MAI ALIBWINO	MAI WAMWALIRA	MWANA ALIBWINO	MWANA WAMWALIRA	ZALEPHEREKA WAPITA KU CHIPATALA	MASIKU ANGATI ATAYAMBA MATENDA?	WAGONA USIKU UNGATI ATAYAMBA MATENDA?
5/10/2007	Christina Mpembeka		✓		✓			1	1
7/10/2007	Lawrenes Kwilile		✓		✓			1	1
10 [illegible]4/2007	Fsleni Lisimba		✓		+			1	1
25/11/2007	Mele Masamba	28/11/07 visited	✓ by	G.D. Mawkwe	EDA - Hunger project			1	[illegible]
8/12/2007	Tshalite Kachinawe		✓		+			1	1
10/121	Ane Musitafa		✓		✓			1	1
12/12/2007	Venika Sitiviri	02/01/07	visited by	G.D. Mawkwe	EDA Hunger Project			1	[illegible]
6/01/20	Mary Mphoka		✓		✓			1	1
7/01/20	Lawrenes Lakis		✓		✓			1	1
8/01/20	Fosileni Lisimba		✓		✓			1	1
8/01/20	Lawrenes Lakis		✓		✓			1	1

Figure 2 TBAs Birth Register

4.4 Results

The research methods provided a clear picture of the extent to which information from the informal health sector at community level is integrated into the formal health sector and why data is lost from informal to formal health sector.

The Result of the TBA ban had varied reactions. Different TBAs reacted differently, some stopped practicing completely because of fear that the community around would report that she is practicing.
TBA1: *"Even when I am told that a pregnant woman is giving birth on the way to the health facility, I do not go, I am scared. … Since they stopped TBAs, Pirimiti is very busy but there is minimal care."*

One of the TBAs having noted the way pregnant women were suffering when they had to deliver along the roads, decided to alert the responsible person at the DHOs office.
TBA2: *"When I noted that most women were delivering on the way, I reported to the TBA coordinator, who came and launched Safe Motherhood and advised me that I am no longer a TBA, but a Safe Motherhood Advisor. … I still report the emergency deliveries [those who can not get to a health facility on time] to Zomba [TBA coordinator] through the health surveillance assistant (HSA)."*

TBAs still assist pregnant women to deliver, but do not record the birth details. Although pregnant women with complications would be referred to the hospital, they would not be assisted in communicating with the health facility for an ambulance.
TBA3: *Before the ban, I would call the health facility for an ambulance whenever there is an emergency, now I just tell the client to find their own means to the health facility."*
It was observed that although TBA3 mentioned that the last delivery was around 6am on the day of interview, last birth recorded in the birth register was ten months before that day.

5 Discussion and Conclusion

A chain is said to be as strong as its weakest link. In the same vein, the effectiveness of the coordination and collaboration of institutions involved with data collection for HMIS can be measured based on the weaker institutional links. Data that feeds into HMIS is collected from the formal and legitimate sources (see section 4.1). The findings of this study point to two weak points in the process of collecting data that feeds into HMIS. (i) After the TBA ban, most of the data from trained TBAs is lost. Before the TBA ban, information feeding into both HMIS and EPI Unit was flowing systematically from community level given that the TBAs used to record antenatal and birth details in the report books and birth registers which was collected by HSAs on a monthly basis. The only exception was data for births delivered by untrained TBAs who do not have report books and birth registers. Even before the ban, these were not recognized by the Ministry of Health System; as such they were operating illegally. Currently, both trained and untrained TBAs do not record the births for fear of being penalized. (ii) The data being collected from the legitimate sources is aggregated and reported differently. The data reported to the EPI Unit is reported on a monthly basis, whilst data being reported to HMIS is reported on a quarterly basis. At most health facilities, the data is collected and kept on loose forms, chances are some of these forms can be lost (particularly in cases where the forms are left with someone else other than the responsible officer) or misfilled.

Although currently TBAs are banned from delivering babies and are therefore not providing information, evidence indicates that they are still an existing and operational health care system, thus still existing organisation. However, their current way of functioning differs a lot (see section 4.4), depending on the individual solutions of the TBAs, one completely abandoned practicing, another is continuing in joint undersatnding with some chiefs, a third TBA practices as an emergency station, and the forth, untrainned one, doing it but hiding it. As articulated by Behrens and Sedera (2004) the gap between the requirements of stakeholders and the organisational implementation strategy may lead to the existence of shadow systems within an organisation. In this case, the gap between the requirements of the pregnant women and the TBA ban has led to each TBA having their own form of a shadow provider, wanted and used by the public as they are responsive to users needs though operating illegally. The consequence being that the data relevant to the HMIS system for proper planning ends up being lost. This weakest link from community (TBAs) to health facility makes the whole HMIS data flow chain weak. As Goldratt (1997) notes, some tasks depend on subtasks; the aggregated data at a health facility is supposed to include all data from community level as well and if community data is missing, then the data collected is not complete and the whole system is not performing efficiently.

The findings also confirm that although rules are set within an organisation, “they are often broken in order to compromise with reality on the ground for better results” (Clegg et al., 2005: p84). The TBAs who still practice claim to be doing it in order to save lives (both mother and child).

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PRAGMATISM OR POLICY: IMPLICATIONS ON HEALTH INFORMATION SYSTEMS SUCCESS

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ABSTRACT

The most fundamental issue for any information system is to produce information that is relevant to organisational goals. A number of research studies have reported failures in information systems, especially in health information systems (HIS) in developing countries. The challenges of success lie in the heterogeneity of the players, the requirements, the practices and some of the policies in place. In some cases, national policies affect the success of the information systems. This paper describes and analyses some of the factors that affect HIS success in developing countries. The aim of this research was to identify, within the environment where the information systems are implemented and used, issues that could be stumbling blocks to their success. Although the use of HIS is seen as a satisfactory outcome of health sector reform, there are certain social aspects, both internal and external to the organisation and system that influence its success or failure.

We highlight the factors affecting HIS using a case study from Malawi. Specifically, we examine the extent to which Sexual Reproductive Health and Rights (SRHR) policy, which includes stopping traditional birth attendants from assisting in births, affects the maternal and child data flow from communities to health facilities and hence into HIS. The SRHR policy was introduced as a way of curbing maternal mortality in a bid to attain the fifth Millennium Development Goal. The findings from an interpretive study reveal that external factors, such as SRHR policy implementation, can affect the quality of data that is input into HIS. We recommend a more pragmatic approach when implementing SRHR policy and provide a new angle to value judgements of environmental context.

Keywords: Health Information Systems; Policy; Pragmatism; Implications

1 INTRODUCTION

The most fundamental issue in information systems (IS) is to ensure that both functionality and data quality are good. A number of research studies have reported failure stories in IS (Fortune and Peters, 2005; Yeo, 2002), particularly health information systems (HIS) in developing countries (Lyytinen & Robey, 1999; Heeks et al., 1999). Now there is more urgency to minimise the failure rate of HIS because countries are working towards achieving the Millennium Development Goals (MDGs). Because three (MDGs four, five, and six) out of the eight MDGs are health related, with the goal of improving public health, more strategies and tools have been set up within the health sector of various countries; these strategies include HIS implementation. However, the success of HIS implementation depends on factors both internal and external to the organisation (cf. Byrne and Sahay, 2007) and on how components that feed data into HIS interact with one another. The external factors are those outside the organisation from the environment where the organisation exists and may include political and legal, socio-cultural, demographics, competitors, and policy factors. Internal factors exist within the organisational work environment, such as needs, structures, and practices. The challenge lies in the heterogeneity of the players, technology, standards, institutions (Walsham, 2010), requirements, practices and some of the policies in place.

External factors, like internal factors, can have an impact on IS success or failure. National policy plays a crucial role in IS (Nicholson and Sahay, 2005), which is an example of an external factor that may affect IS performance. With respect to HIS, events at the WHO may be affected by what happens in terms of data collection and analysis at a local level in a particular context (Walsham, 2010) and vice versa.

Overall, the use of HIS is seen as a satisfactory outcome of health sector reform, despite the fact that data incompleteness in HIS is reported in the literature (cf. Nyamtema, 2010). Health sector reform considers only the functionality of HIS, as is the case in the Kleinian post-functionalist view of IS, where the delivery of information is seen as a secondary aspect of HIS (Klein, 2000). Attention is paid to functionality only, although IS success cannot be measured by functionality alone. IS success is interrelated and interdependent with other measures, such as information quality (Al-Adaileh, 2009; DeLone and McLean, 1992). Information quality requires quality data that are accurate, complete and timely (Koronios, 2006). It is therefore necessary to have a critical review of the processes, practices, and factors that may affect IS; otherwise, its implementation can remain mythical and ceremonial (Noir and Walsham, 2007).

This paper describes and analyses factors that can impede HIS success in developing countries. The impetus for this work consists of external factors such as policies in place that may have an impact on HIS. This paper critically examines a situation where a HIS has been effectively implemented but where tension between policies introduced within the health sector and pragmatics (among other factors) causes most of the data to be missed. We use empirical evidence from the Malawi health sector, specifically looking at maternal and child data. The analysis highlights the need to take into consideration both internal and external factors (national, regional, and international) that may affect HIS. The findings indicate that the Sexual Reproductive Health and Rights (SRHR) policy of stopping traditional birth attendants(TBAs) from assisting at delivering babies (MoH, 2009) has unintended effects on HIS data quality, causing most of the data to be missed. SRHR policy is a factor external to HIS. The SRHR policy was introduced in January 2007 as a way of reducing maternal mortality in a bid to attain the MDGs, especially MDGs four and five, which are aimed at improving infant and maternal mortality, respectively. Among other things, the SRHR policy redefines the role of TBAs from delivering babies to advising and motivating mothers to appreciate the need to go to skilled birth attendants (SBAs) at health facilities (MoH, 2009).

The paper is organised as follows. Section 2 discusses IS in developing countries and the socio and external factors that affect HIS data quality within organisations. Section 3 describes the methods used during the research, providing a general background and the contextual reality of the environment where the SRHR policy was implemented. Section 4 discusses the case as it relates to the literature. Recommendations are listed in section 5. Section 6 draws conclusions from the findings.

2 LITERATURE REVIEW AND THEORETICAL FRAMEWORK

2.1 Information Systems in Developing Countries

Avgerou (2010) stresses the need for IS studies to have theoretical plurality where the findings can apply to different contexts. Nevertheless, she acknowledges that context remains a distinguishing characteristic of IS studies in developing countries. Another characteristic unique to IS initiatives in developing countries is that they are donor funded (Mosse, 2004; Mursu, 2002), leading to a struggle to balance between organisational and donor needs. The organisational facet, as articulated by Michelis et al. (1998), includes organisational goals, policies, regulations and plans. Paradoxically, when policies are influenced by donor needs, this influence denies organisations the freedom to dictate their own needs free from external factors. As early as 1975, Lucas highlighted the need to include social perspectives in IS, a call that has been repeated many times (Heeks, 2005; Mingers and Stowells, 1997; Orlikowski and Iacono, 2001). Overall, information systems exist in a context (Heeks, 2005), and the factors within the context can have an impact on the IS.

2.2 HIS in Developing Countries

HIS in developing countries have been designed and implemented in the same way as in developed countries in the sense that

> *They ... provide routine information to higher level health administrations. Most of this information is of a statistical nature, that is, in the form of indicators. The data from which these indicators are calculated arise in basic health facilities ... and hospital wards.* (Krickeberg, 2007: p.9).

The objective of HIS is to produce relevant and good-quality information in support of health action (WHO, 2006). However, the HIS implementation process in most developing countries overlooks differences in environmental contexts (Mosse, 2004), as mentioned by Avgerou (2010). Large proportions of the population in developing countries reside in rural areas, and most of these constituents are poor – the "bottom billion", as Heeks (2008) calls them. Social exclusion prevents the bottom billion from accessing health care (ibid.), which compels the populace to seek care from traditional providers. In 2005, the World Health Organization (WHO) launched the Health Metrics Network (HMN) as a way of strengthening HIS in developing countries. Most literature about HIS in developing countries indicates that HIS incorporate data collected at health facilities as the lowest level (Chaulagai et al., 2005; Krickeberg, 2007) and do not capture all of the data that exist in a community (Chaulagai et al., 2005). This practice leaves the needs of the bottom billion under-represented in current HIS (Shaw et al., 2009). Although the aim of an HMN is strengthening the HIS, its assessment tools have no provision for monitoring data generated by traditional health providers in their local communities, which compromises data quality.

2.3 HIS Data Quality

Factors that affect HIS data quality include an underinvestment in data collection systems (WHO, 2006); the fact that data are mostly captured from health facilities; fragmentation and duplication in data collections due to varying interests between governments, donors, and implementing partners; and the overburdening of data collectors (Shaw et al., 2009). Currently, the HMN framework does not address the data quality problem (ibid.). Data quality issues need to be addressed because the social and economic impact costs billions of dollars (Laudon, 1986; Strong et al., 1997) and, in the health sector, improving the data quality and its costs go beyond building and implementing IS (cf. Shaw et al., 2009). Data quality is acknowledged as a major challenge in HIS, and a shortage of qualified personnel is cited as the primary cause (Shaw et al., 2009).

For HIS, the contextual data quality category, as described by Strong et al. (1997), is very critical. This consideration addresses the relevancy, timeliness, completeness, and amount of data. In this research, any data related to maternal and child health are relevant and the issue of concern is data completeness.

2.4 Theoretical Framework

The literature discussed above raises three challenges that need to be taken into consideration in this study if data quality is to be achieved in HIS. IS implementation is context dependent, and the context in developing countries is donor dependent. These relationships limit the freedom to specify organisational needs. Another factor is that, in developing countries, the bottom billion are socially excluded from reaching health care, yet data collection for HIS starts at the health facility level. Finally, leaving out data generated within the bottom billion can cost billions of dollars, thus further straining societies that are already strained.

The excluded data in the context in which HIS are implemented are as important to HIS success as the included data. This study analyses and highlights the social factors that contribute to data being excluded from HIS and emphasises that factors both internal and external to the organisation may affect IS data quality. The presence of "barriers to rationality" (Klein and Hirschheim, 2001) that exist in the context considered may also affect the quality of the data.

3 METHODOLOGY

We undertook a case study in Malawi over a period of two years, from June 2008 to July 2010. The research was conducted within the Health Sector. A research case study was chosen because this approach brings about an understanding of a complex issue and extends the experience of what is already known through previous research. "Case studies emphasize detailed contextual analysis of a limited number of events or conditions and their relationships" (Soy, 2006). A case is a "unit of analysis" (Miles and Huberman, 1994, p. 25) where empirical inquiry that investigates a contemporary phenomenon takes place. This study is focused in terms of its own approach and boundaries and is informed by the methods and outcomes of a number of previous studies accessible in the literature (Chaulagai et al., 2005; Kanyimbo, 2006; Galimoto, 2007) as well as from the situation analysis undertaken in association with this research.

Within a case study, the research adopts an interpretive tradition where the subjective meaning that people create (Orlikowski and Baroudi, 1991) within their environment is studied and analysed. Data is collected using a qualitative approach. As researchers, a qualitative approach gives us an opportunity to make knowledge claims based on the meanings gathered from the experiences of individuals who are interviewed and observed and from the historical perspective of the documents that were analysed. This scenario is in line with Creswell's (2003) arguments on the qualitative approach.

This research started with a situation analysis via a literature search. This analysis was followed by the initial information gathering, which took place in two health catchment areas (one in a rural and the other in an urban setting), the district health office, and the Ministry headquarters. Data were collected using interviews, observations, informal discussions and document analysis. Interviews were interactive and semi-structured and were used in an attempt to have an in-depth understanding of the situation "on the ground" and to obtain information on the impact of the SRHR policy on the way that the data are collected and reported. During this period, a total of 105 interviews were conducted, as indicated in Table 1 below.

These interviews provided a platform to develop greater awareness of the factors that impact the way that data are collected and reported from one level to the next. In addition to the interviews, two focus group sessions were conducted; one session was with a village committee in one of the catchment areas, and the other session was with a team of health surveillance assistants (HSAs) at a health facility.

In some cases, the interviewees may respond based on what they feel the interviewer is looking for. To curb this tendency, a supplemental method for obtaining the required empirical knowledge was used, that of observation. "It is difficult to acquire a feeling for the intricate interrelations between health care professionals and documentation techniques without having seen the work patterns itself" (Berg, 1999). Hence, there is a need to observe in an attempt to make sense of what has been reviewed from the documents. The document analysis included a review of the health facility registers and tally cards, a review of traditional birth attendants antenatal clinic (ANC) reports, births registers, village health registers and health passports for children whose data were collected.

Table 1 – Interview Participants

Year	Number of Persons Interviewed									
	Headquarter		District		Health Facility		Community			**Total**
	MoH	NSO	DHO	District Comm.	Nurse/ Clinical Officer	HSA	TBA	Chief	Mother	
2008	2		3		2	2	4	1	50	64
2009					4	2	3	1	20	28
2010	1	2		1	3	4				11
Total	3	2	3	1	9	8	7	2	70	105

The data collection tools consisted of (i) interview guides for the district health officer, the HMIS statistician, the program coordinators, the health facility officer-in charge, the HSAs, non-public institutions, the TBAs, the chiefs, and the mothers of babies under 24 months of age; (ii) informal discussions with members of the community; and (iii) workshops. The interview guides (an example is given in appendix 1) for the TBAs, chiefs and mothers were in both the English and the Chichewa (local) languages. Our case study was drawn from the Malawi health sector and examined the environment where HIS are used. The community level was the main lens of focus, as all data that flows upwards is generated from communities. Data analysis was a continuous process.

The analysis process started with the identification of stakeholders involved within the health sector, particularly the relationships of the interviewees. This analysis was performed using data displays (Miles and Huberman, 1994). The data collected were then grouped into related aspects to identify emerging patterns, themes, and meanings. Because different data collection methods were used, the data were triangulated to weigh the evidence and to detect any contradicting findings. A limitation of this work is that generalisation will be based on one case study.

4 THE CONTEXT OF THE CASE

4.1 Background

Cammack (2006) argues that Malawi has not 'got the politics right' and that this constraint keeps Malawi from becoming a developmental state. A developmental state is described as one that has achieved relative autonomy from socio-political forces in the society and is driven by an urgent need to promote economic growth in an attempt to protect or promote itself in a world or regional context of threat and by a need to win legitimacy by delivering steady improvements in the material and social well-being of its citizens. One important attribute of a developmental state that Cammack (2006) mentions, which is relevant to this study, is "a competent economic bureaucracy insulated from politics". Cammack (2006) cites several examples that demonstrate an absence of insulation from politics, i.e., where specific development-related activities, such as agricultural policy, were made by the United-Democratic-Front-led government (1994-2004) "in light of how they would affect party-politics and the interests of elite factions rather than how they would promote national development". There is an intertwining of the public sector and the politics that creates political-economic control (Booth et al., 2006). "This has left a legacy in the political and ideological culture of Malawi, which has had an enduring effect. It has also compromised the integrity and respect of the public service, and hollowed out its capacity to perform effectively, to promote the provision of public goods and contribute to developmental velocity" (Chingaipe and Leftwich, 2007).

Malawi has a population of about 13.1 million, 87% of whom reside in rural areas ((NSO-MPHC, 2008) and a good proportion of whom fall in the "bottom billion". The country has three administrative regions; north, central, and south. Each region is divided into districts and the districts are subdivided into traditional authorities. In total, the country has 28 districts. The traditional authorities are composed of villages. Each traditional authority is headed by a chief whereas each village is headed by a village head. Malawi has a predominantly agricultural economy (NSO-WMS, 2007). Malawi reported a GDP per capita of $703 in 2006 (UNDP, 2008).

4.2 Landscape of the Malawi Health Sector

Only 14% of the population are closer than a 30-minute walking distance to the nearest health facility (NSO-WMS, 2007; pp.10-12). Mortality rate figures remain high in Malawi, with a neonatal mortality rate at 33 per 1,000 live births, an infant mortality rate at 72 per 1,000 live births, an under-five mortality rate at 122 per 1,000 live births, and a maternal mortality ratio of 807 per 100,000 live births (NSO-MICS, 2006). The health sector includes both modern and traditional health providers. Modern health services are offered by public (belonging to the state) and private health institutions. These include the Ministry of Health (MoH), the Christian Hospital Association of Malawi (CHAM), NGOs and private institutions. The traditional health providers include traditional birth attendants (TBA) and traditional healers.

Health care in Malawi is hampered by a shortage of medical staff, drugs and diagnostic resources and, according to Zere et al. (2007, p.2), follows "*the inverse care law* and is pro-rich", a factor that makes most people in the rural areas use traditional health providers. The shortage of medical staff has also led to programs that supported traditional birth attendants (TBA) and traditional healers in some cases. The United Nations Population Fund (UNFPA) has supported Traditional Birth Attendant (TBAs) programmes in Malawi since 1970 as a way of improving maternal and child health. This support has continued through the Safe Motherhood Initiative since it started in 1987. In the 1990s, UNFPA jointly with WHO and UNICEF issued a statement on TBAs to reflect common goals that contribute to the global effort aimed at improving reproductive health (UNFPA, 1996). The health services data are influenced by both modern and traditional health providers.

The total number of health institutions across Malawi is 1,030, and out of these, 83% (850) provide primary care only (MoH-CSR, 2007; NSO-MPHC, 2008). A census that was conducted in December 2007 revealed that there is a health facility to population ratio of 1:13,824 and it was noted that the facility population ratio in rural areas is much higher than that of urban areas, with an average per facility of 9,870 people in urban areas and 14,749 in rural areas. This distribution reflects an increase in home deliveries (Zere et al., 2007) in the rural areas. In 2008, 32% of the deliveries were reported to have occurred in the community (NSO-WMS, 2008; pp.26). Table 2 shows the percentages of pregnant women who were assisted at delivery by trained health personnel, those who attended antenatal appointments in the first trimester, those who attended postnatal appointments within the first two weeks after delivery, and the percentage of fully immunised children below the age of one year. The table indicates that deliveries by trained health personnel were much higher in the year beginning July 2003 and ending in June 2004 and dropped by 20% in the year July 2004 to June 2005. There was then a constant increase from 2005 to 2009. Both antenatal and postnatal visits were higher in the year beginning July 2003 and ending in June 2004 and, following a brief decrease, had a constant increase from 2005 to 2009. On the other hand, immunisation figures indicate a constant increase from 2003 to 2009, with figures for 2007 to 2008 much higher than those of 2008 to 2009. This table emphasises the point that not all pregnant women are assisted by trained health personnel when giving birth. Furthermore, not all children are fully immunised before reaching the age of 12 months.

Table 2 – Maternal Health Figures 2003 to 2009

	2003 to 2004 (%)	2004 to 2005 (%)	2005 to 2006 (%)	2006 to 2007 (%)	2007 to 2008 (%)	2008 to 2009 (%)
Delivery by Trained Staff	58	38	40	42	46	52
First Antenatal Visit, First Trimester	12	7	6	7	8	9
Postnatal Visit within First 2 Weeks	34	18	19	21	24	26
Fully Immunised Under 12 Months	51	55	59	62	70	65

Source: *Ministry of Health HMIS Bulletin*, 2004, 2005, 2006, 2007, 2008, 2009; Malawi

4.3 Root of Malawi HMIS

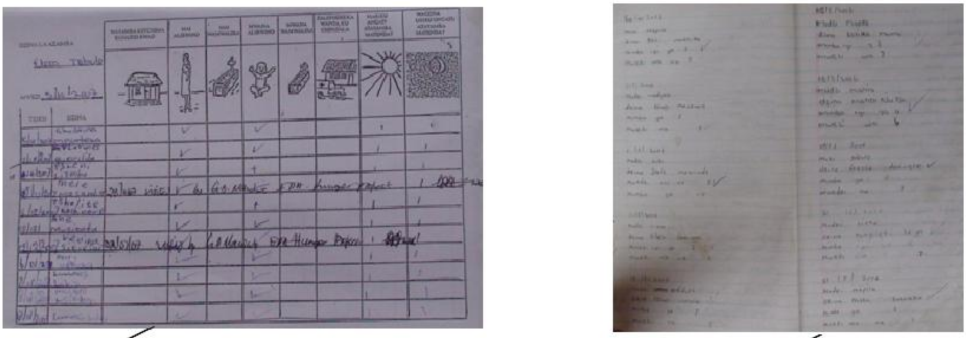
In 1999, the Malawi Ministry of Health (MoH) implemented a health sector reform that, among other things, included the Malawi HIS, which is called the health management information system (HMIS). The HMIS was developed to improve planning and programme implementation of health services and the availability and use of routinely collected data at all levels (community, health facility, district, and national) within the sector with all vertical information systems integrated into one system. Prior to 1999, the systems used to gather information for the management of health services were too many and uncoordinated, and the HMIS was meant to integrate all vertical systems into one (Chaulagai, 2005). The implementation of HMIS faced some challenges, which included low data quality in terms of completeness, reliability and timeliness (HMIS Bulletin, 2006-2009). Currently, the HMIS is both computer and paper-based. The computerised HMIS is available at district and national levels whilst health facility and community levels still use paper-based systems.

5 ANALYSIS OF THE CASE

5.1 The Data Collection Process for the HMIS

The document analysis and interviews establish that data collection is mostly done within the health facilities when clients/patients visit the facilities. Within facilities, there are well-structured mechanisms (form and registers) that are used to collect data. From the findings, it was clear that some anomalies and errors do occur during data capturing. Some of the anomalies and errors observed in the registers at this level include additional information errors and omission errors. An example of an omission error is a case where data for certain dates are not captured.

However, maternal and child data are not generated only at the health facility level. Because Malawi's population is mostly rural (80%) and of the rural population, most are in the bottom billion, a substantial percentage of pregnant women deliver their babies with TBAs. This data needs to be captured and recorded as well. The TBA coordinator confirmed that not all TBAs were supported by the health sector, a fact that led to the creation of two groups prior to 2007 – untrained TBAs, who were not recognised by the health sector and who were not recording data generated, and the trained TBAs, who were legitimate. Prior to the SRHR policy implementation in 2007, the trained TBAs were recording the maternal and child information in TBA birth registers and in hand written antenatal care reports, as shown in Figure 1 below.



Traditional birth attendant village register

Traditional birth attendant antenatal care report

Figure 1 – Tools Used to Capture Data by the Trained TBAs

These data would then be collected and aggregated by the Malawi community health workers, known as health surveillance assistants (HSAs), once every month. The HSAs are the only link between the modern and the traditional health sectors. HSAs have a mandate to collect data from the communities on a regular basis; however, they are overburdened with other duties and only manage to visit and collect data from communities once a month. Once the data are collected from the TBAs, the TBAs are not given any informational feedback on the deliveries. The limited visits to the communities by the HSAs affect the maternal and child data completeness and accuracy; not all data generated within communities are captured. Ordinarily, the data could be projected using the census figures; however, the way the country has been demarcated makes it difficult to have a figure that is close to accurate for the population per village, per community, or per health catchment area.

Administratively, Malawi has been divided in different ways, depending on the sector (see figure 2); the agricultural sector is divided into agricultural development divisions as the first level, into the rural development projects, and then extension planning areas as the final level. The whole country has 8 agricultural development divisions, 31 rural development projects and about 150 extension planning areas. The education sector is divided into divisions (6), education districts (34), followed by zones (these comprise 6-10 schools); the last level is the schools. Politically, the divisions are parliamentary districts first and then local government wards. Depending on the parties, some further divide into branch and area levels. The National Statistical Office (NSO), the office responsible for government figures through population census and surveys, divides the country by region and then by district (and within districts there is a distinction between rural and urban areas). Rural areas are further divided into traditional authorities, while urban areas are divided into administrative wards. Both traditional authorities and administrative wards are further divided into enumeration areas.

None of the other sectors have the same divisions as the health sector. The lowest division from the health sector (the community level), like the lowest divisions from the agriculture, education and political sectors, do not have population data. These divisions are all different from the lowest level for the NSO, making it difficult to have projected data for births and deaths within communities based on population figures for this level, as some of the enumeration areas[1] cut across communities.

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[1] Lowest level for NSO census population figures.

5.2 The Interplay between SRHR Policy and Maternal and Child Health Data

The idea to have an HMIS was part of the process of implementing government policies and plans for health sector reform. These plans were conceived in 1999, as mentioned earlier, and the implementation started in 2002. Once the MDGs were introduced, countries had to conform to the strategies of attaining the MDGs and, in some cases, had to design their own strategies. One of the strategies to attain MDGs four and five for Malawi was the implementation of the SRHR policy. Specifically, we focus on section 3.2.2.4 of the policy, which prevented traditional birth attendants (TBAs) from assisting in deliveries and encouraged pregnant women to go for skilled birth attendants (SBAs) at health facilities (Cf. MoH, 2009: p10). Implementation of SRHR policy had no prior assessment as to how it might affect the existing systems. Although the implementation of the HMIS faced some challenges, the overall functionality of HMIS was sufficient. However, the introduction of the SRHR policy brought in a new dimension to the completeness of the maternal and child health data.

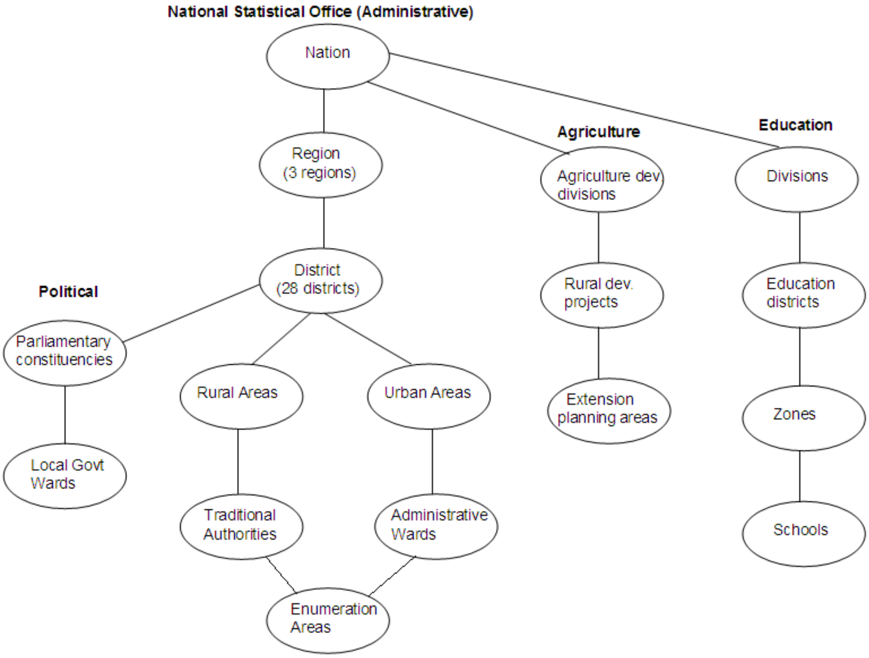

Figure 2 Spatial Hierarchies used in Malawi (modified from Benson et al., 2002)

The challenges facing the modern health sector, which included shortages of human resources and insufficient health infrastructure, led to initiatives that have been supporting TBAs as complements to modern health services since the late 1970s. This situation created two different groupings of TBAs because not all TBAs were supported: the *trained* and *untrained*. The trained TBAs were taught how to record the antenatal visits and how to detect danger signs of a pregnant women and were supplied with provisions for use during deliveries (such as aprons, weighing scales, and gloves). On the other hand, the untrained TBAs were not recognised by the health sector. The data generated by the untrained TBAs were not recorded.

Given the 80/20 rural-urban dichotomy of Malawi's population and the fact that there are insufficient health facilities and SBAs, most mothers in rural settings face challenges to access health facilities. As a result, these mothers seek assistance from the TBAs. When babies are delivered at home, there is a high chance of missing postnatal monitoring within the critical period (the first 24 hours) and immunisations; this lack of health care may lead to an increase in data that are not recorded (births, deaths and causes of deaths) in the HMIS. Prior to the SRHR policy implementation, most of the data missing were that generated from untrained TBAs.

Implementation of the SRHR policy was a turning point for the trained TBAs: they continued delivering babies, but they stopped recording data. One of the TBAs had this to say:

> *I no longer record the births after they stopped us from delivering babies*.

This meant that neither the trained TBAs nor the untrained TBAs record any documentation for the antenatal visits, births, deaths, and emergencies they attend. Prior to the SRHR policy, the Zomba district had 80 registered trained TBAs reporting deliveries to the TBA coordinator's office. Once the SRHR policy was implemented, only two TBAs continued giving reports. These two TBAs also stopped after a period of time.

Due to various reasons (such as beliefs or transportation), most pregnant women within the "bottom billion" still deliver their babies with TBAs or at home as a matter of choice. This statement confirms the results of a study that was conducted in Mangochi district Seljeskog et al. (2006), where pregnant women found it easier to be assisted by a TBA during delivery because they would either walk to the nearest TBA or the TBA would come to their homes and assist them.

The other setback is that although MoH introduced the SRHR policy in 2007, the infrastructure that causes pregnant women to wait for delivery remains a challenge to provide at most health facilities. As a result, some women go back home to deliver there. The Officer in Charge at a Health Centre said:

> *There has been about a 70% increase in deliveries yet we only have two nurses. ... But some pregnant women are delivering underground* [at TBAs or at home].

Ideally, HSAs would reside in the villages with the community for easy monitoring. However, some of the HSAs live far from the communities that they serve. HSAs prefer to stay close to where they can get better services and basic needs such as water. Quoting the words of one HSA at a health centre, she said:

> *The water here is very salty; I could not stand it any longer, so I moved to the trading centre where the water is much better.*

By residing away from the community that they serve, the HSAs are not able to capture all of the data from the villages assigned to them, partly because of the distance from their place of residence to the villages. This distance gives enough room for deliveries to take place in the communities without the knowledge of the HSA, and the data generated remain invisible.

Within the communities, a number of factors influence the choice of whether one should go to a health facility or a TBA for delivery. An interview with one of the chiefs revealed the deep-rooted beliefs that exist within the communities; it would require incessant effort and training to emancipate the communities from such beliefs. The chief had this to say:

> *Government has forgotten that many people prefer TBAs because they can handle difficult conditions better than the hospital; like when the baby is not at the right position in the womb or if the woman 'wamangidwa[2]'.*

In some cases, pregnant women are forced by their relatives and elders to deliver at home with the belief that once the pain becomes unbearable, the woman will be in a position to reveal the real father of the baby.

5.3 Missing the Denominator

Although the HMIS as a tool is in place, not all of the needed data are collected, which is not the fault of the information system. Instead, the major factors are the policies in place, the processes, the practices, and other human factors. Following the SRHR policy implementation, most TBAs are reluctant to report births to the chief or HSAs. In theory, each and every birth in a village is supposed to be reported to the chief, who is to record the birth in a village health register (VHR). In some villages, women are expected to report to the chief when they become pregnant, so that the chief can play a role in reminding them to go to a health facility early (before labour pains start). However, most women do not comply, as expressed by a mother of a 7-month-old baby:

> *Why should I tell the chief about my pregnancy as if he is my husband*?

To confirm the loss of data, the Executive Director of the National Organisation of Nurses and Midwives in Malawi said, referring to the TBAs:

> *They never really stopped ... what happened is that they went underground for fear of being fined a goat. So, in terms of statistics, we were losing out as deaths or births from these people were not recorded.*

5.4 Reality on the Ground

In some cases, the mothers would be willing to go to deliver at a health facility, but most interviewees complained of transportation problems, particularly during the rainy season. There have been cases where women have taken heed of the advice to deliver at a health facility, but once there,

> *according to some mothers, they deliver alone; others are assisted by a cleaner; some opt out and deliver on their way going back home; and these reports come back to us* (TBA, Leader of Village Safe Motherhood Committee).

The process of recording data generated within communities has its share of challenges. Prior to 2008, HSAs used to record data from communities on loose paper or notebooks. Some of these would be misplaced at the HSAs' homes or within the health facilities before data were transferred into facility registers. In 2008, MoH introduced village health registers (VHRs) to be used for data collection within communities. However, not all HSAs were trained on how to use this complicated data collection tool. HSAs admitted that the VHR has many sections and that it is difficult to use.

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[2] A belief that a woman who is due for labour is failing to start labour pains because of being bewitched.

> *One needs training for one to complete it competently ... so far, very few HSAs have completed VHR training ... and data collection is still being done through plain papers or exercise books* (HSA at a Health Centre).

Within the health facilities, it was admitted that the pressure of work has increased. Table 3 indicates a consistent increase in the number of women attending antenatal visits, the number of babies delivered by SBAs, and the number of live births from 2007 (when the policy was put into practice) to 2009. However, from the table, it is not conclusive whether the increase is because of the SRHR policy, because the figures for 2004 to 2005 are higher than the figures reported for 2008 to 2009. Looking at the percentages, 2004 to 2005 (54%) and 2005 to 2006 (54%) reported the highest percentages of babies delivered by SBAs. The remaining 46% were delivered at TBAs and at home.

The health facilities are few and far between in most parts of the country. In some places, the health facilities are non-existent and, although the chiefs have the mandate to stop the TBAs from delivering the babies, they are forced to allow their assistance to mothers due to the situation at hand.

Table 3 – Figures for Zomba District

	2004-2005		2005-2006		2006-2007		2007-2008		2008-2009	
		%		%		%		%		%
New ANC Visits	32714		28656		30531		32833		31940	
Delivery by Trained Staff	17521	54	15584	54	14164	46	15352	47	16235	51
Live Births	17066	97	14334	92	13741	97	14835	97	16083	99

Source: *Zomba District Health Office,* (2010).

According to the Central Monitoring and Evaluation Division (CMED), a department responsible for HMIS in the MoH, the flow of data within the Malawi health sector is a two way process, as shown in Figure 3a; however, the reality on the ground is different, and the data mostly flows from the bottom up, as depicted in Figure 3b.

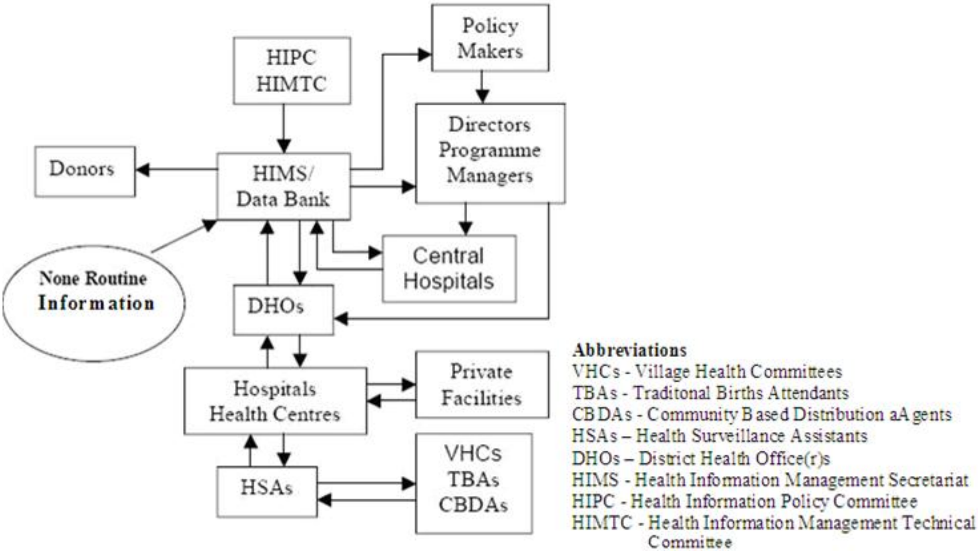

Figure 3a Formal Data Flow within the Malawi Health Sector

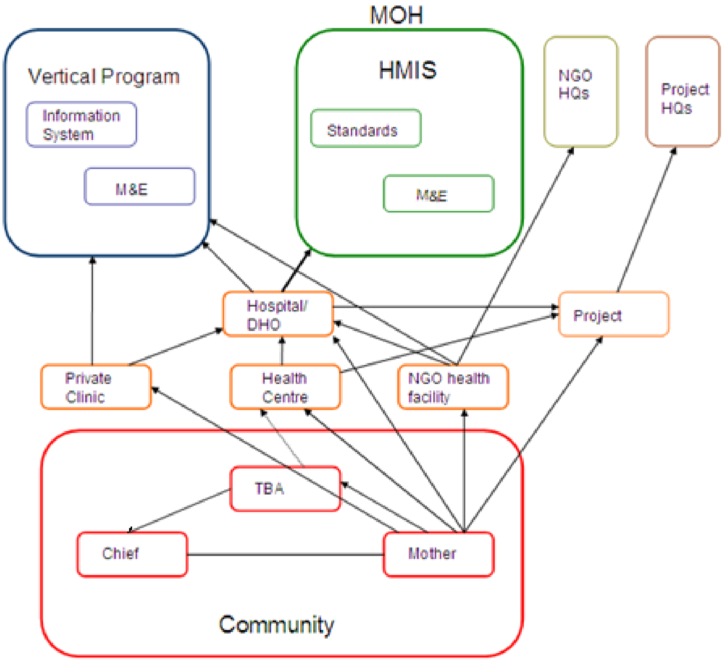

Figure 3b Actual Data Flow within the Malawi Health Sector

While Figure 3a indicates that data flows from the village health committees (VHCs) and the CBDAs to the HSAs, the VHCs and the CBDAs hardly exist in most communities. Furthermore, not all data generated from health facilities go through DHOs; some of the data are reported to the vertical programs responsible. This arrangement contributes to the inaccuracies and incompleteness of the data that goes into the HMIS.

6 DISCUSSION

The aim of this paper was to highlight and analyse the factors that affect data quality and impede HIS success. In the case presented, the HMIS is implemented across two sectors - modern (also referred to as formal) and traditional (informal) health sectors. A number of differences are noted in the two sectors: i) The types of systems in use: within the informal sector, only a paper-based system is used, whereas in the formal sector, both paper-based and computer-based systems are used to collect, aggregate and report data. ii) Understanding of the benefits: those collecting data at the point of care in the formal sector may be more aware of the benefits of capturing this data because, in return, they receive monthly supplies for their facilities based on the reported figures, whereas in the informal sector, TBAs used to record the data just because they were told to so. They would not get any feedback and it was difficult for them to appreciate the benefits of documenting the data. To them, the documentation was done as a ritual after assisting birth. Using Noir and Walsham's (2007) words, the recording of the data for the TBAs was "mythical and ceremonial".

Because the informal sector was not aware of the benefits of recording data, it was easy for them to drop this unnecessary ritual when the SRHR policy was put in place. Once the TBAs stopped recording data, the HSAs lost a central point where they could collect available data from the informal sector. Indirectly, the SRHR policy implementation had an unintended negative effect on the quality of maternal and child data.

The Malawi case confirms sentiments made by Anderson (2004) that often government policies in poor countries are detrimental and become an obstacle to development. Dettmer (1997) echoed the same sentiments that "most of the constraints we face in our systems originate from policies". The SRHR policy was implemented in a rush as a way of reducing maternal mortality in a bid to meet the MDGs without a thorough situational analysis. Here, we have a situation where the implementation of SRHR policy to curb maternal mortality resulted in negative side-effects on the HMIS. Where policies are put in place without apposite situation analysis, unintended effects may result (OQPF, 1990). The trends, according to indicators that are in tables 2 and 3, do not indicate significant improvement.

Some practices are difficult to change. For instance, some beliefs about why mothers deliver their babies at home are deep-rooted and acceptable within communities. Instead of changing these practices, the communities choose to hide the delivery data. Changing such institutionalised practices requires a number of interventions both in the short and long term, ranging from developing awareness programs, increasing the number of health facilities, improving the infrastructure within existing health facilities, increasing the number of skilled birth attendants within the facilities, increasing the feedback to the communities, and improving on the mode of transportation. Many as these factors do not have a direct bearing on the HMIS, although they have an impact on the SRHR policy. Implementation of the SRHR policy in turn affects the data that are recorded in the HMIS.

The SRHR policy is a health issue; its implementation was meant to improve maternal and child health. On the other hand, health information is crucial for the improvement of the health status of a country's population, and the HMIS is a basic tool for health management and a key input for health information (MoHP, 2003). For any information system to be a success, both its functionality and the quality of the data entered into the system need to be acceptable. Data quality cannot be achieved where the data are incomplete. Thus, like any information system, the information from an HMIS has to be reasonably complete. However, since the SRHR policy was implemented, this level of completeness has not been achieved.

The fact that the smallest units within the health sector, the community level, where TBAs practice, have no official census population figures to project the missing statistics means that once the data are missed and the mother does not go for a check up or immunisation, the data are lost forever.

This case provides insight into problems faced by many information systems during their implementation, which impede their success and yet are external to the system itself. In some cases, the factors may be external to the organisation where the system is implemented. Within the Malawi health sector landscape, the infrastructure and human resource capacity do not provide for safe motherhood without cooperation with TBAs. The policy fix is based on the notion that putting a policy in place translates into having the policy implemented religiously. The problem is that there is a dichotomy between the policy on the one hand and practice on the other, and the gap that exists results in a number of unintended consequences. Similarly, in information systems, we design technological solutions and, at times, ignore the social aspects that might interplay with the systems. Just like the Global Fund initiative could create a "Medicines without Doctors" situation if the strengthening of the health systems component was to be dropped, (Ooms et al., 2007) stopping traditional birth attendants could create a policy without practice in some cases, particularly in the rural areas.

In the literature review, it was noted that researchers acknowledge and agree that an information system is not only a technical matter but also a "deep interrelation of technical and social aspects" (Berg, 1999), requiring a socio-technical approach. As articulated by Mumford (2000), some of the problems are outside of the normal experience, yet their consequences, if not mitigated, may be disastrous. The issue of the SRHR policy is completely outside the HMIS design, development, and implementation, yet it is interrelated with the completeness of the information that is input into the HMIS.

Mumford identifies coordination as an important skill in information systems, while Bolman and Deal (2003) add that coordination should be both vertical and lateral, as coordination is the only means to know of any change within the environment where a system is implemented. As a policy, SRHR was not localised during its formulation; for as much coordination as there was at the top level within the ministry, the stakeholders where the policy was to be implemented (i.e., the communities) were not consulted during the policy formulation. Coordination with lower levels began during the policy implementation as a way of reinforcing its implementation. This strategy created a policy-reality gap.

Mumford (2000) also stresses the importance of knowledge, as knowledge leads to appropriate action, enabling vigilance. Data from the communities that were previously compiled by TBAs and collected by HSAs are no longer present in health facilities and the HMIS because the SRHR policy implementation altered the practices of those who collected such data. This point emphasises the need for an iterative approach between analysis, design, implementation and evaluation (Berg, 1999). Berg stresses that the weaknesses of the system can be identified only after an evaluation.

Klein and Hirschheim (2001) identified different values in their quest to explore ways of ensuring that the "socio" aspect of socio-technical approaches in information systems is exhaustively covered. They pointed out that these values could be determined internally or controlled by external factors. Furthermore, they acknowledge the presence of "barriers to rationality", which may exist in the practice of organisational decision-making and in the presence of competing stakeholders, each with their own set of values. The findings in this research highlight both the internal and external values that control the situation. The HMIS is implemented by the Ministry of Health (MoH); internally, there exist different stakeholders, such as vertical programmes, District Health Officers, Coordinators, HMIS units, HSAs, and TBAs, that control the situation. External stakeholders, such as NSO (where population data come from), donors (where funding comes from) and International organisations (where goals such as MDGs are introduced) also play a role. This scenario is further explained in Table 4, below.

While the MDGs necessitate that the maternal mortality rate is reduced and that the proportion of births attended by SBAs is increased, this goal cannot be achievable if the IS that produce information used for planning are provided with incomplete data. There is, therefore, a need to have data collection mechanisms that are more encompassing in both traditional and modern health sectors. There is also a need to optimise the interrelationships between the social aspects of the organisation and the systems used.

Table 4 – Stakeholders, Motivations, Actions and Impact on Data Quality

Stakeholder	Motivation	Action taken	Impact on HIS & Data Quality
International Organization	Reduce poverty by the year 2015	Introduced MDGs	
MoH Official (policy maker)	Attain Health – related MDGs at country level	-Introduced SRHR policy to reduce mortality rates -Stopped TBAs from assisting births	Negative, data from communities not captured
HAS	Collect data from communities	-Use TBAs as contact point -Visit communities only once a month	Negative, data from communities not captured
TBA	-Assist pregnant women during births -Earn a living	-Continue assisting births underground -Stopped recording data	Negative, data from communities not captured
Mothers (Pregnant women)	Get assistance when delivering their baby	Continue using TBAs	Negative, data from communities not captured

The evidence presented clearly indicates that the introduction of the SRHR policy is a question of MoH wanting to comply with global standards, the MDGs. However, this step was taken without regard to the practicality of implementing such a policy in an environment where there is a shortage of health personnel and health infrastructure. This scenario recalls Cammack's (2006) point that emergencies are ignored in part because of the tendency to concentrate on the less contentious causes. We have a situation where the high maternal mortality rate is blamed on TBAs, yet the more contentious causes (such as a shortage of health personnel, poor infrastructure and planning based on incomplete information) are left unaddressed.

Cammack (2006) mentions an important attribute of a developmental state relevant to this study, which is "a competent economic bureaucracy insulated from politics". This SRHR policy was introduced to conform to the international community that Malawi had committed itself to at the 1994 International Conference on Population and Development in Cairo and on other associated international declarations such as the Millennium Development Goals (MoH RH Strategy, 2007). In this case, the politics of conforming to international goals were more prominent than how the policy would affect the local situations.

7 RECOMMENDATIONS

We recommend a more pragmatic approach to implementing a new policy within an environment. We envisage that for any information system to produce relevant information that guides policy making sufficiently, the quality of data provided for the system and the quality of the information produced should be acceptable. This goal can be achieved only if the data are complete. As such:

- For future policy implementations - there is a need to have a thorough situation analysis on the needs and challenges in different catchment areas within each district prior to policy implementation.
- The policy should be implemented in stages based on the availability of health facilities and limitations in each catchment area.
- Because the services and living conditions in some of the villages are not conducive for health surveillance assistants who should be capturing health data continuously, it is recommended that the HSAs be provided with better mobility to ensure that they cover their designated areas and that the roads be accessible.
- Members of the community need to be understood, as some may take a long time to understand the benefits of going to a health facility and the benefits of reporting births. Furthermore, the communities require thorough explanations in simple language coupled with a carefully considered approach and attitude.
- Community members and TBAs need to be empowered and need to be responsible for data generated in the absence of the HSA. Communities should have a contact person where all of the data generated can be deposited.

8 CONCLUSIONS

The practical implications of this research focus on the need to critically assess reality on the grounds that it may enable or limit the completeness of information produced by an information system. It is clear that each context where an information system is developed remains unique. In this case, we have seen a constraint on an information system that arose after the system had already been implemented, yet that was hindered with respect to the completeness of the data collected.

While HMIS development is seen as a satisfactory outcome of health sector reform, it takes the Kleinian post-functionalist view of an information system, as the completeness of the health information is disrupted by SRHR policy implementation. The implementation of HMIS therefore only reveals the government's attempt to strengthen health care services, but with insufficient situational analysis. Consequently, these actions do not have the intended effect on health planning and status, as the outcome does not represent reality on the ground.

"Success takes a balance of forces but technology is not always necessary. And it is almost never sufficient" (Scott Morton, 2000, p.5). What matters are the way that the different players coordinate and the presence of a continuous evaluation of the system during its implementation, which is key to avoiding indeterminacy. It is not only the technology or the inclusion of the social aspects that leads to successful implementation of an information system but also continuous human vigilance.

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Making Data and Knowledge Visible for Health Information Systems

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Abstract

Purpose. To highlight why some data and knowledge remain invisible in the traditional health sector and why some data sources are considered less credible in a bid to improve the way data is collected at community level. This will help curb the problem of having incomplete data in health information system.

Methods. We used the maternal and child data from Malawi. The study began in June 2008 up to July 2010. We used interpretive approach to qualitative data analysis. Data was collected using interviews, observations, and document analysis. The data was analyzed using different methods which included triangulation, data displays, weighing the evidence, and following up surprises.

Results. There are challenges during data collection related to the data collectors and data sources. The health sector's most trusted and reliable statistics are those from the national surveys. Ironically, the reliable source of the national surveys figures is a health passport whose data comes from a health facility, and not all mothers within a community would have health passports. However, relying on data collected using respondents' health records excludes a good proportion of the population which has no access to health facilities.

Conclusions. Our study concludes that it is important to utilize the local knowledge that is situated in the context where the relevant data reside to ensure that no data is missed.

Keywords: Data Quality, Local Knowledge, Health Information Systems, Data Sources, Traditional Health Sector, Invisible Data

Making Invisible Data and Knowledge Visible for Health Information System

1. INTRODUCTION

Information systems (IS) have been used as one of the tools in the health sector reform in developing countries. The health sector in developing countries comprise of two institutions: modern and traditional sectors. Institutions can either be formal or informal where the formal uses constitution and laws, and the informal are associated more with social traditions and practices [1]. The practices in the traditional sector are considered to be informal whilst practices in the modern sector are considered to be formal. The difference being that modern health sector uses modern (western) medicines whilst the traditional sector uses traditional (indigenous) medicines and practices. The traditional health sector is mostly within rural communities. When the formal and informal institutions overlap, there is a high chance of an institution to succeed [1]. According to Strauss, performance of work in any organization whether formally or informally constituted is a collective act and includes interactions [2] to get things done. Within the health sector, interactions between formal (modern) and informal (traditional) sector are essential to ensure that data captured into the health information system (HIS) is complete. The challenge is that most data and knowledge generated within the traditional health sector remain invisible since most reform activities and HIS applications concentrate more on the modern health sector.

Within developing countries, the rural-urban dichotomy has disparities geographically, demographically, economically, and environmentally. Geographically, most areas are rural, demographically, the rural population is higher than urban, and economically most of the poor reside in the rural settings. Further, availability of infrastructure in general including health infrastructure is asymmetrical with more infrastructure in the urban areas. Yet, despite having a higher population, there are fewer health infrastructures and fewer trained medical professions within the rural settings or communities. As a result, most of the population cannot afford or access modern health services and they continue utilizing the traditional health providers. In Malawi, there is an 80/20 rural-urban population dichotomy and coincidentally, up to 80% of the population utilizes traditional health providers. This leads to a situation where the health sector has a lot of data but most of the data generated within the traditional health sector remain invisible. With the rural setting having a higher population, most of the health data is generated within the rural context. However, with HIS applications concentrating on the modern health sector, some data sources existing in the rural settings within the health sector are considered less credible.

The motivation of this part of the study was that since a large population utilise traditional health providers. In the case of babies who are born within the traditional sector, if they are not registered by way of going to health facility for check up or health surveillance assistants (HSAs) recording the birth, those babies are not allocated vaccines.

Organizations, including ministries of health (MoHs), strive to have information systems that have good data quality. However, in some cases [3, 4] the organizations may have all the data needed to produce information for decision making but fall short of appropriate knowledge of where to find data, which data to use, and why use that data. Poor-quality data, if not identified, can have negative impacts on an organization [4].

As we approach 2015, there is more urge for quality data within organizations such as health sectors to improve monitoring of the millennium development goals (MDGs). It is more important for health sectors as three out of the eight MDGs are health-related. Health data is derived from multiple sources (national surveys, census, health facilities, and communities). In some cases, there are contradictions in the data sources. It is important therefore for the health managers to have knowledge of which data sources to use in order to obtain quality data for strengthening health systems. Travis et al. acknowledge the challenge of getting existing and emerging knowledge about effective strategies to strengthen health systems into practice [5]. In the health sector, lack of knowledge about which data sources are more credible can result in poor data quality, ill-informed decision-making, and poor planning; in the long run impeding the attainment of the MDGs. Tee et al. [4] give an example of how lack of knowledge resulted in 25 million pounds loss as Burger King recalled contaminated meat batches [Cf. 4:p336]. Knowledge of which batches were contaminated would have meant recalling fewer batches.

This paper looks at a situation in the health care system where some data have remained invisible and some data sources are considered less credible than others. We analyze how externalization of local knowledge can make the ignored data and data sources visible and more credible. The more visible the data is, the quality of data going into health information system (HIS) will improve. We address the following question: *how can externalization of knowledge generated at local level improve data quality in the health sector*? The specific empirical setting used is maternal and child data in the Malawi health sector. Data collection methods and data sources in the health sector both in general and using Malawi case is described. Local knowledge theory [6, 7] is used to analyze how knowledge created at different levels (community and health facility specifically) of the health sector can be utilized to enhance data flow, and how sharing of that knowledge can improve data quality in HIS. Specifically, we build our argument based on externalization of knowledge according to Nonaka and Takeuchi's SECI model [8]. Improvements in health care can be made if both local (indigenous) and scientific modalities of healthcare knowledge are leveraged [9].

The paper first describes data collection methods in health and their strengths and weaknesses at a broad level. This is followed by a discussion of the theoretical lens, where local knowledge and how it is used in this paper is explained. The next section looks at the methodology that was used to collect data. Then we present an analysis of the findings, assessing contradictions of the data sources used in the Malawi health sector, particularly community based ones. This is then followed by a discussion of how the theoretical lens presented fits with the case.

2. DATA COLLECTION METHODS IN THE HEALTH SECTOR

Data used to generate information in health is collected either routinely as a continuous process (routine methods) or as a single event (non-routine methods) [10, 11]. Examples of routine methods include 1) routine health unit-managed data collection where data is collected based on patient/client encounters in a health facility or through outreach clinics 2) routine data collection managed directly by a community, 3) civil registration, [11] and 4) sentinel surveillance [10]. The non-routine health data collection methods include 1) quantitative surveys, 2) qualitative rapid assessment methods, 3) research projects [10], 4) informal investigations [11] and 5) “soft” information obtained through meetings with individuals and groups [11], and other special studies. These methods are complementary as “no single data source can provide all information required for planning and managing the health services” [11]. The low access to health services in most developing countries necessitates the combination of data collection methods. Koot’s framework of information generation mechanisms has a place for all different types of data collection methods (see figure 1). The data can be collected from a health unit or from a community. The IS whose data are collected from health units are referred to as facility-based HIS, whilst those that have data collected from communities are community-based.

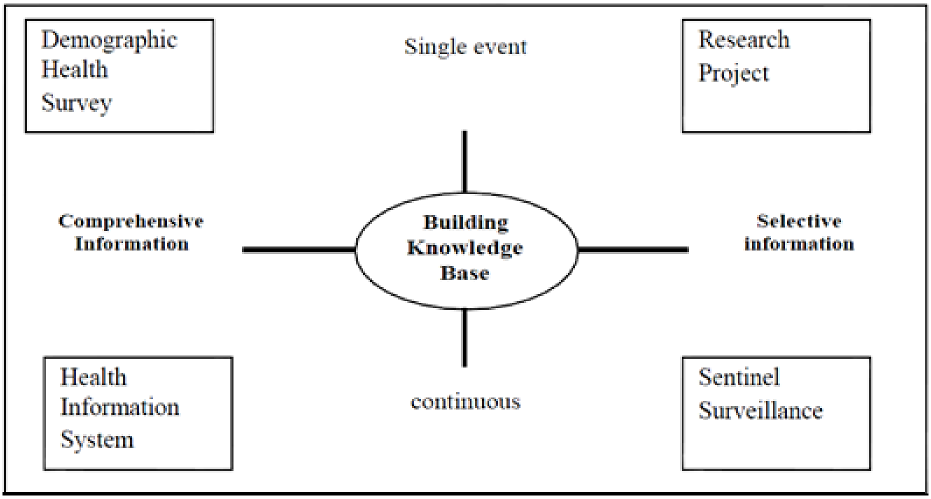

Figure 1 - Information Generation Mechanisms [10]

While many HIS combine health unit and community data collection methods, each of the two types of HIS (facility-based and community-based) have data collection methods that best suit them. Table 1 shows the different data collection methods used in the two types. The ticks (√) indicate the intensity which a particular method is used with √√√ as the highest and absence of tick means that method is not in use.

Although table 1 shows the different methods of collecting data for community-based HMIS (CBHMIS), there are very few and isolated community-owned data collection systems [10]. This is because communities rarely initiate research activities, neither do they own data analysis processes. Therefore data analysis is done outside the community where data was collected and rarely do the communities receive feedback.

Table 1 - Data Collection Methods for the two types of HMIS

Data Collection Methods	Health Management Information System Types	
	Facility-Based HMIS	Community-Based HMIS
Routine health unit data collection	√√√	
Routine community data collection	√√	√√√
Civil registration	√	√√
Sentinel surveillance		√
Surveys	√	√√√
Research projects	√√	√√
Informal investigations		√√√
Soft information obtained through meetings	√	√

The data collection methods are applied to the two health sectors; modern and traditional. However, the traditional health sectors do not have direct access to facility-based HMIS (FBHMIS) in most of the rural communities; therefore it is important to have CBHMIS and community-based data collection methods which can be used in communities where FBHMIS are not present. “Quality data collection and appropriate use of information at this level can provide some of the most valuable information for health services management, as well as for management of essential public health functions—from reporting of births and deaths; to notification of disease outbreaks; to identification of high-risk individuals, pregnancies, and births; and to more peripheral information about household coverage, safe water supplies, and sanitation” [12]. We will therefore examine the different methods for collecting data within communities. The methods for CBHMIS will be examined highlighting the ones with flaws.

2.1. Routine Community Data Collection

The strength of this method is that there is a link between communities (traditional health sector) and facilities (modern health sector) through community health workers (CHWs). In some areas, the CHWs collect baseline data for the communities which they use to compute the population figures based on head count [11, 13]. This method works well in situations where there is high level community participation, a strong commitment of village leadership, and a culture of volunteerism [Cf. 12, pp. 13-14: Case of Thailand].

However, there is no appropriate mechanism or technology for collecting data at community level. The means by which data are collected vary depending on members of communities involved. Information needs should drive demand [12]. However, most communities are not aware of their information needs because people’s comprehension of the benefits of capturing data and information that comes out of the captured data has not been met. Since information needs are not clear, the data are not analyzed and used at community level and in some cases, health workers end up recording data which are not relevant [14]. Further, much as the data and information collected needs to transform into action, this is not always the case.

2.2. Civil Registration

Civil registration is the only way to count everyone and track all births and deaths in a country. Civil registration is beneficial to both individuals and countries. It provides a basis for each individual’s legal identity within a country and countries are able to identify their most pressing health issues. In many developing countries and particularly in Africa, functional national vital/civil registration systems are lacking. WHO [15] acknowledges that it only receive reliable, cause-of-death statistics from 31 out of its 193 Member States; and two-thirds (38 million) of 57 million annual deaths are not registered globally [15]. Further, almost 40% (48 million) of 128 million global births go unregistered. Although civil registration is something that all countries (developed and developing) need, only a few developing countries have civil registration systems in the past 50 years [15]. This is not surprising as it takes years to establish well-functioning civil registration systems. Countries such as France and the United Kingdom took more than three centuries to establish a functional civil registration system. Their civil registrations evolved from church registries [15]. In Viet Nam civil registration was mandated under the first Vietnamese national civil code in 1956, to date, they have no vital statistics published from civil registration sources [16]. The picture is getting brighter as international efforts to improve comparability of vital statistics seem to be effective, judging by progress in collection and publication of data. It is now possible to establish a functional system in a few decades. Examples include: Jordan, Malaysia, South Africa, Sri Lanka and Thailand [15].

2.3. Surveys and Research Projects

National surveys collect a wealth of information on different topics. Some health surveys use quantitative methods whilst others use qualitative methods for data collection. These surveys provide a chance of collecting data on a large scale. The capability to use either qualitative or quantitative methods provides an opportunity to use methods best suited for a particular context and understand better social and cultural dynamics related to health. Qualitative research allows for an in-depth understanding as individuals speak with their own voices; discuss their concerns and priorities using concepts meaningful to them. The most common source of data in the health sector is Demographic and Health Surveys (DHS). DHS are nationally-representative household surveys that provide data for a wide range of monitoring and impact evaluation indicators in areas of population, health, and nutrition [17]. DHS Surveys have large sample sizes (usually between 5,000 and 30,000 households) and are conducted every 5 years.

In surveys, data for some of the needed indicators are difficult to collect. For example, maternal mortality, *this represents deaths to women that occur during the reproductive process, meaning during pregnancy, childbirth, or within 2 months after the birth or termination of a pregnancy*. "The methodology for collecting maternal mortality data is to ask, female respondents to list all their siblings, that is, all children born to their mother starting with the first born, and whether or not each of these siblings is still alive at the time of the survey. Current age is collected for those who are still alive, and additional information is sought on the year of death and age at death of deceased siblings. To establish whether deaths were maternity-related, respondents are further asked questions for all sisters who died at age 12 or older" and whether she was pregnant when she died or she died during childbirth or she died within two months after the end of a pregnancy or childbirth [17]. In developing country context it is very difficult to talk about death; some consider it a taboo to talk about a dead person while others do not want to be reminded about their loved ones whom they have lost. As such some of the responses may not be accurate. On the other hand, two or more sisters may report death of their sibling and this may bring in duplication. Child birth and deaths indicators are also tricky to measure.

2.4. Census Data

A census is a count of all people and households in the country. It is conducted every ten years and provides population statistics from national to community level for government, local authorities, districts, and communities. For example, the last census for Malawi was in 2008. Prior to the 2008 census, the available national population figures were from the 1998 census. Census data is captured by enumerators. Since the interval between two censuses is a ten year period, the projected census figures become outdated at times.

3. THEORETICAL LENS

In this paper, we explain how local knowledge can be externalized and used based on the local knowledge theory [6, 7] as it has a part to play in development interventions. On the other hand, the role of local knowledge remains ambiguous [18]. Local knowledge is used because within the health sector, knowledge that is relevant to real life, real time, and real space matters most.

3.1. Local Knowledge

Local knowledge is situated in the local culture and environment and has both practical relevance and social significance [7] which makes it more relevant in the process of data collection within the health sector community level. This is illustrated through different characteristics of according to Antweiler [7:p16-17] (see table 2). The characteristics in table 2 show that local knowledge can be diverse and dynamic. The diversity and dynamics of the local knowledge need to be understood as part of the cultural system within the context. An understanding of the context is also beneficial to the information systems in use within the environment. Local knowledge is known to improve implementation activities in different sectors i.e. disaster preparedness although it remains marginalized by institutions [19]. Understanding local knowledge and practices help identify the local needs, what is acceptable in the local context, and how participation can be solicited to ensure support from communities for external action. In the health sector, ignoring the local knowledge means marginalizing the health practices that take place within the local communities (the traditional health sector).

Table 2 – General model of local knowledge: ten interrelated qualities [7]

Key Characteristic	**Aspects**
1. Knowledge plus skills	Combination of specific factual knowledge and practical action-oriented skills
2. Adaptation to situational dynamics and variability	Keyed to common, but never precisely identical features of a particular place, thus adapted to ambiguous, mutable, and thus in-determinant issues
3. Empirical local basis and experiential saturation	Based on local observation, low cost/-risk trial-and-error and natural experiments, proven by coping over a prolonged period in the laboratory of life
4. Redundancy and holism	Represented parallel in several cultural

	domains; embeddedness; holistic orientation through systemic relations with other aspects of culture
5. Tacit nature of knowledge	Often implicit, uncodified intuitive, embodied, less verbalized, non-disciplinary
6. Informal learning	Oral transmission, decentralized and piecemeal learning, learning by imitation, demonstration and apprenticeship more than by instruction
7. Scientific character	(Partially) systematic, methodical, parsimonious, empirical-hypothetical, comprehensive and generating causal theory
8. Optimal ignorance	Information only as detailed and accurate as it needs to address the problem; no more, no less
9. Evaluation criterion, test	Practical efficacy as the yardstick vs. e.g. theoretical consistency, parsimony, and elegance
10. Resulting actions and problem solutions	Solutions familiar and thus broadly accepted by local peoples, oriented towards satisfying and optimizing (vs. maximizing) and the use of local resources

It is a known fact that the differences in social status affect perceptions, access to knowledge and, the importance and credibility attached to what someone knows [20]. The place where the knowledge is generated also has an influence on the credibility. Often, the knowledge possessed by the rural communities, in particular women, tend to be overlooked and ignored [20].

3.2. Tacit Nature of Local Knowledge

The tacit characteristic of local knowledge makes it difficult to be shareable as it remains implicit, embodied, and uncodified. Nonaka and Takeuchi SECI model, illustrate how knowledge that is tacit in nature can be made explicit [8]. Tacit knowledge resides in the know-how and is accumulated through experience and intuitions. On the other hand, explicit knowledge is formal, codified, systematic and capable of being communicated and shared [21]. Figure 2 illustrates the four ways that knowledge can be created and converted using Nonaka and Takeuchi SECI model [8]. Tacit knowledge can be converted into explicit knowledge through the process of externalization, and from explicit to tacit through internalization. Knowledge can also be converted from tacit to tacit through socialization and from explicit to explicit through combination [8].

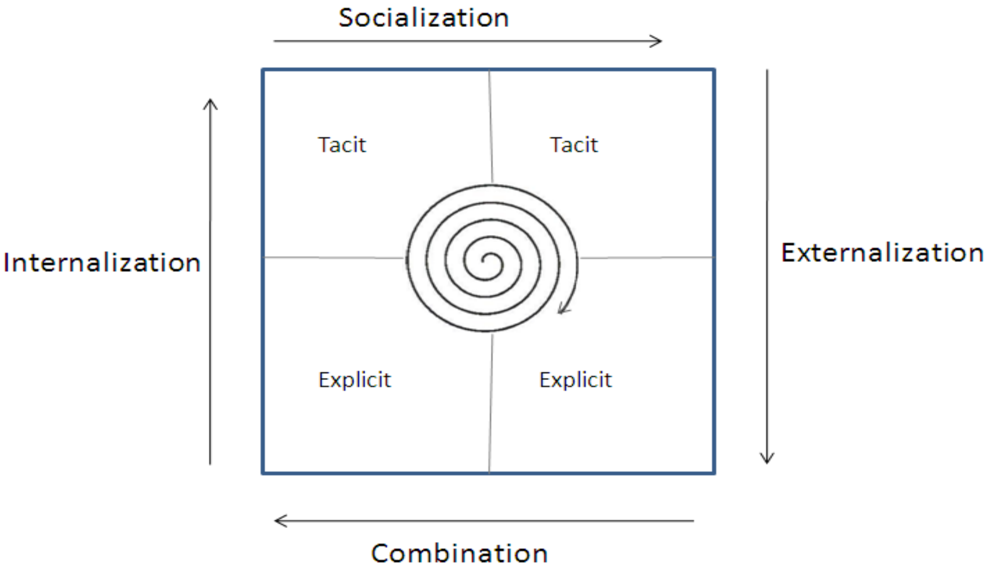

Figure 2 SECI model [8]

The local knowledge which is tacit in nature can therefore be made explicit through the process of externalization. Much as the know-how is considered to be tacit [22], it can also have an explicit component [23]. Local knowledge has both the tacit and explicit nature. Nonaka and Takeuchi [8] have modeled knowledge transfer as a clockwise spiral process; starting with socialization; the process that transfers tacit knowledge from one person into tacit knowledge in another person [8]. An example is TBAs who learn their skills from their mothers by taking part as assistants and observing what they are doing. Next is externalization where tacit knowledge is converted into explicit knowledge. For example, a TBA would share their experiences orally to someone. Documenting such practice would, convert that tacit knowledge into explicit. Knowledge externalization can be achieved in two ways: by *articulation* of one's own tacit knowledge - putting ideas in words, metaphors, analogies; and through *eliciting and translating* tacit knowledge of others into an understandable form. Dialogue (oral communication) is an important means for both [8]. Explicit knowledge can be converted to a new form of explicit knowledge through a process called combination or to tacit knowledge through internalization. Combination allows knowledge to be transferred from one group to the other across organizations. TBAs can internalize knowledge after being trained.

Our focus in this paper is to highlight that the local knowledge is shareable through the processes of socialisation and externalisation of the tacit local knowledge. In the process of externalization, different interests that create barriers to develop shared meanings are revealed; these may have political consequences [24]. “When interests are in conflict, the knowledge developed in one domain creates negative consequences in another. This makes knowledge to be both a source of innovation, and a barrier to innovations [25]. Knowledge is situated in practice [26] and it is through practices that knowledge is continuously created and converted. The knowledge produced during work practices may be valuable to an organization but contrary to its rules [27]. However, there are situations where disobeying the rules may save the situation [27]. Work practices that are not part of organizational rules and routines may also reflect knowledge that is useful to the organization [21]. The need to have both local and scientific knowledge is essential, as some of the practices can be better explained and understood using local knowledge.

4. RESEARCH APPROACH

This study took place from June 2008 to July 2010. We used interpretive approach to qualitative data analysis. Qualitative research is well-grounded because it is conducted through intense and prolonged contact with the situation being studied. Researchers are able to understand meanings, beliefs, experience and the social-cultural context and gives an opportunity to collect descriptive information, that may support or attempt to invalidate concepts and theories. In this study, the descriptive qualitative reports will offer an opportunity to communicate to decision makers in the health sector the impact of the knowledge generated within communities. In addition, the descriptive reports will help information systems developers understand the need to take into account local understanding of the situation where the system will be implemented. With qualitative method, one can precisely follow the events and their consequences; this makes it possible to come up with explanations of the situation [28]. The richness and depth of explorations and descriptions is one of the advantages that qualitative approach offers [29].

The empirical setting for the study was the Malawi health sector which is hierarchical with four levels (national, district, health facility, and community levels). At the national level, data was collected at the MoH headquarters; for district level, data was collected at the Zomba district health offices (DHO) and two health catchment areas (one urban, the other rural) were used to represent both the health facility and community levels. The study included representatives of the following health providers: mothers with babies (0 to 23 months of age), skilled and traditional birth attendants and women who assist in deliveries within the study area, coordinators and statistician at the DHO’s office, head of health facilities, researchers who have done related work, chiefs, members of community, national statistical office personnel and enumerators, and health surveillance assistants (HSAs).

Data was collected using interviews, observations, and document analysis. The interviews were guided by a set of questions outlining the broad themes used in the process of data collection for the different groups of interviewees. Those interviewed included: 2 ministry of health officials at national, 3 at district, and 6 at health facility levels; 7 traditional births attendants, 70 mothers of babies under 24 months, 2 chiefs, 7 community health workers (CHW), 1 enumerator who collect census and surveys data, and 1 national statistics officer. In total there were 90 individual interviews and 3 focus group discussions (1 for CHWs, 2 for members of the community). More individuals interviewed were from community level because at this level, data collection mechanisms are elusive and knowledge remain tacit than explicit.

Although sample size for qualitative research study is usually small, a large number of mothers was interviewed (totaling to 70), particularly those from the urban setting. The sample size of mothers from the urban and rural areas was unbalanced with 60 mothers from the urban area and 10 from rural area. There was need to have a large sample of urban area mothers to find out: whether indeed fewer mothers from urban area utilise traditional health providers -TBAs. If only 10 mothers from urban setting were interviewed, the results would have been as if all pregnant mothers in the urban areas utilise modern health sector. Continuing with the interviews in the urban area verified medical dualism and that a smaller percentage utilise TBAs.

Individuals do not always have sufficient skill or motivation to articulate their useful knowledge during interviews. The observations helped to understand the knowledge socialization within the communities. For example, the way knowledge is passed from a TBA to her female children by observing. Observation also helped because in some cases, what people say they do and what they actually do is different, observing them gave a complete picture. In the initial group of interviewees we did not include enumerators and national statistics officer. However, after preliminary analysis, the results pointed to a possible vicious cycle in the data sources for health information. There was need to verify whether health passports were considered as the core and most reliable source of data for maternal and child health by enumerators.

The collected data were analyzed using different methods which included triangulation, data displays, weighing the evidence, and following up surprises [28]. The four methods used to analyze the data were chosen because there was need to validate the data through verification. Methodological triangulation [30] was used where three methods (interviews, observations, and documents analysis) were used to gather data. The results found through document analysis and interviews were verified using observation. The use of different methods gives a more detailed and balanced picture of the situation. To make sense of the way data is communicated, we used data displays, linking the different actors involved and illustrating the flow of data from one point to the other. The evidence was weighed and surprises followed by cross checking the initial findings i.e. initial findings from document analysis verified through interviews; findings on how survey data is collected verified with the national statistics staff and enumerators.

The analysis began during the data collection. This type of analysis was almost inevitable because, being in the field, collecting data, it was impossible not to start thinking about the data being collected, what was being observed and discussed. All the data was handled by the researcher to ensure that the data is secure and confidentiality is guaranteed. Analytical memos were used to record the field observations and findings. The field notes were hand written, and in some cases graphics in the form of digital photos were taken. In the process of collecting data, what was more important from the beginning was to establish whether indeed mothers give birth outside health facilities as is reported in the documents analyzed. Once this was confirmed; we wanted to establish whether the babies born within communities are taken to the facilities for check up.

5. ANALYSIS

Like most developing countries the Malawi health sector is pluralistic, with both modern and traditional health providers. Malawi health sector is demarcated into districts and health facility levels. Each health facility has its own catchment area comprising a number of villages – the community level. The mandate of each health facility is to provide both curative and preventive out-patient care to its catchment area, as such; they need to know the total population they serve. This is particularly important to ensure that each health facility gets enough medical supplies and drugs to cater for its catchment area.

5.1. How Data is Collected at Different Levels

The district level is not directly involved in data collection, the data they use is sent from the health facilities within the district. The only exception is when the program coordinators go for outreach programs; in such cases they collect the data directly. On the other hand, the figures which they use to project denominator values are obtained from the ministry of health (MoH) headquarters. The ministry gets them from the national statistics office. In some cases, the program coordinators use the population figures from the health facilities as denominators. These figures are obtained through head counts done by community health workers within their catchment areas. The community health workers in Malawi are known as Health Surveillance Assistants (HSAs) and they are the only link between communities and health facilities. Each HSA is responsible for several villages within a catchment area (covering a population in between 3000-6000). However, the head-counted population figures credibility is questioned by the policy makers.

5.2. Challenges during Data Collection within Communities

In principle, HSAs are supposed to go from household to household on a daily or regular basis, recording vital statistics (deaths, births and population variables) and disease outbreaks within the community. Data collected by each HSA would then be reported to a health facility. However, due to work overload, long distances to catchment areas, and large populations to be covered, these visits are as few as once a month. This problem is also true for surveillance; HSAs hardly have capacity for regular surveillance. At the same time, there are no CBHMIS within the catchment areas, making it more difficult to capture births and deaths data from the communities.

Within communities, there are two categories of TBAs – the trained and untrained. In areas where trained and untrained TBAs live close by, each group tends to protect their knowledge from the other as a way of ensuring that they get most clients. Trained TBAs who would have internalized modern ways of assisting mothers would be reluctant to share their knowledge with the untrained TBAs. Untrained TBAs would also ensure that they guard their tacit knowledge and keep it to themselves. The untrained TBAs would also be discreet about assisting clients and their knowledge remains situated within their practices. It therefore becomes difficult for the HSAs to collect data generated from the TBAs. When the policy stopping the TBAs from assisting in deliveries was introduced in 2007, the trained TBAs also went underground. This led to more data generated within communities to remain invisible.

During census and surveys, enumerators obtain under-five child's details from the under five health records in health passports (books). The health passports are obtained from the health facility. The child details are entered into the mother's health passport when a child is born at a health facility, or when a mother takes a child born at a TBA or at home for check up or immunization at the health facility. During surveys, the health passports are the main source of information. Where health records are missing, some enumerators ask the mothers to give the child's information, however, some enumerators do not and they may end up missing data. In some cases, even when the enumerator asks for child's details from the mothers, some mothers may not be comfortable to talk about it if their child is dead. Therefore, in the absence of regular surveillance data; it becomes difficult to capture let alone verify the data of those children born outside health facilities. This may lead to a situation where the data captured is inaccurate. Babies born at TBAs or at home do not have records unless if they were immunized or reported for check up. In some instances, the mother would not reveal to enumerators details of a baby who was born at untrained TBA as a way of protecting the unregistered TBA. Further, some mothers hide their baby's details if they feel they are either too young or too old to have children, or because they feel shy to reveal the number of children they have.

In some countries, the missing data would still be captured through vital registration. The Malawi case is different as there is no vital registration in place, and there are no national Ids given at birth. This makes it difficult to track the births.

5.3. Differences between Enumerators and HSAs as Data Collectors at Community Level

Survey enumerators and HSAs are the two modes used to collect data from the community level. As both groups of data collectors (HSAs and enumerators) continue with their job, patterns emerge based on their experiences as they collect data and they develop more knowledge and experience. However, there is a difference between the two groups. The knowledge which enumerators develop from one area can only be applied to another area (not the area where it was developed), and depending on the context, this knowledge may not be useful. For example, an enumerator may learn that according to culture; access into a particular village can only be possible after seeking permission from village chief. This may not be the case in all villages. For HSAs, they are able to apply the knowledge developed as they interact with the same group over and over. The knowledge developed by HSAs can enable them to identify people within their community whom they can trust and use those people as point of data collection. An example is where HSAs have been using TBAs as their source of data on births and deaths generated within communities – a make shift CBHMIS.

5.4. From Data to Information for Planning

Over the years, the Malawi health sector has come up with a number of initiatives including the development of a health management information system (HMIS) as a way of easing the process of planning. The HMIS draws its data from various sources including health facilities (patient data), census data and data from health household surveys. However, health facility supplies are based on projected census and household survey figures. The dilemma is sometimes the projected census data might be inaccurate. Having noted shortfalls of the projected census figures, health facilities came up with their own solutions using their local knowledge. This led into collection of head-counted figures and they do conduct head count for their catchment areas to ensure that the information used for planning in the health sector is derived from accurate data. The head counting is done by HSAs, people who are familiar with the environment and the communities' practices. Policy level on the other hand does not recognize the head counted figures as credible. However, the findings pointed to some contradiction of the source of data which is considered as more credible.

5.5. Contradiction of Data Sources

The paradox is that the health sector's most trusted and reliable statistics are those from the national surveys, yet most of its data is collected using respondents' health records. On the other hand, head count figures collected by HSAs are disregarded despite the fact that they are a better representation of the situation on the ground. HSAs, unlike survey enumerators, have a more permanent presence within communities and have access to, and knowledge of, health cases with and without records from health facilities. Enumerators on the other hand, interact with communities during surveys only; they hardly know the people they are collecting data from. This leads into a vicious cycle (see figure 4). Figure 4 illustrates a situation where the main source for official census and survey data is the health facility and main source of head-counted population data is the community. The difference is that: Census data is commissioned by the National Statistics office (NSO) and their data is collected by enumerators. In the communities, enumerators use health passports as their most reliable source for maternal and child data. On the other hand, head-counted population data is commissioned at health facility level and is collected by HSAs who live within the communities and know the people well enough as they interact with them regularly. Ministry of Health (MoH) uses the NSO population figures as the main and most reliable source for use in its health facilities. Ironically, the reliable source of the NSO figures when enumerators are collecting data from communities is a health passport whose data comes from a health facility, and not all mothers within a community would have health passports. Although the MoH considers NSO as their source of data, reality is - the actual source of this data is the health facilities. This particularly holds in the case of maternal and child data. However, relying on data collected using respondents' health records excludes a good proportion of the population which has no access to health facilities. The usefulness of statistics depends on their quality, yet in this case the statistics used has compromised quality.

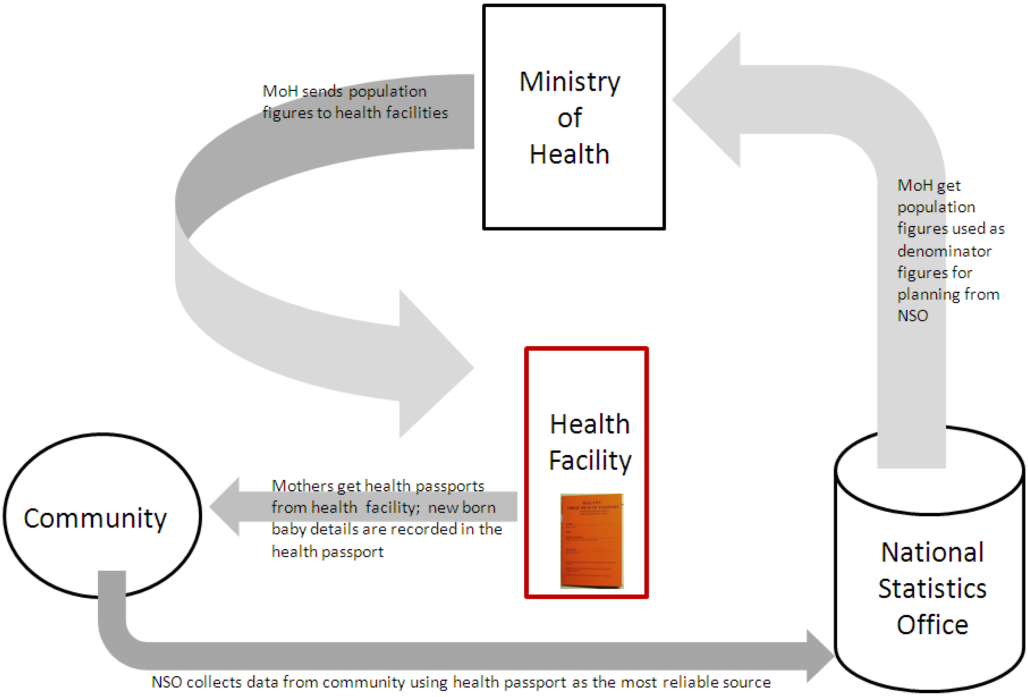

Figure 3 – Vicious Cycle of health sector data sources

5.6. Alternative Source of Population Figures

An alternative source of population figures used by health facilities is data collected through head counts. The head counted population figures capture more data from communities because the HSAs know their communities well. However, these figures are not considered to be credible by policy makers. Although District Health Offices are given projected population figures from MoH based on population census to work with; health facilities also compute total population within their catchment areas based on head count by the HSAs. This allows them to have a more accurate figure for the total population within their communities. As they conduct door to door visits within their locality, HSAs acquire relevant knowledge about the population which they serve. This was acknowledged by the district health staff that uses data gathered by HSAs to make their plan, rather than the population figure projected from census. One of the coordinators and one of the District Health Officers said:

> *The head count data is more accurate than the census data.*

As they interact with communities, HSAs are also in a position to know the common diseases, sanitation condition and cultural practices that influence health actions within their catchment areas directly or indirectly. For example: they would know where a pregnant woman delivered her baby in cases when they do not go to a health facility. This is possible because of the familiarity they have with members of the villages they work in. Since they live and work within the same communities, HSAs develop local knowledge which enables them understand their communities better. This knowledge helps them to know the population within their communities and the target population for the different health services, which they offer.

5.7. Acquiring Local Knowledge – HSAs vs. Enumerators

In the case of Malawi, HSAs essentially live in villages among the community. In terms of training, HSAs are at par with enumerators who collect data for national surveys; they would have reached high school (form 4) and obtained their certificate. In addition, HSAs undergo 10 weeks training on health care. This places HSAs at an advantage compared to the enumerators in a number of ways as summarized in table 2.

Table 3 Comparison of HSAs and Enumerators

Health surveillance assistants (HSAs)	**Survey Enumerators for DHS**
Reside in communities where data is collected	Only come once to collect the required data
Good rapport with communities as they are familiar with them	Rapport on 'interviewer' – 'interviewee' basis
Able to make follow ups	No follow up visits
Work relationship present as they interact on a regular basis	No work relationship
Data from health records can be verified during surveillance	No chance of verifying the data collected

The HSAs acquire more local knowledge as they interact more with the communities where this knowledge is generated. However, the enumerators' data is considered more credible by virtue of being the official statistics database.

6. DISCUSSION AND CONCLUSION

Where there is an overlap between formally and informally constituted parts of an institution, there is a great chance of success [1]. A health sector would therefore be more successful with the two sectors interacting and working together collectively. However, the case emphasize the point by Warburton and Martin [20] that knowledge possessed by rural communities tend to be overlooked and ignored. In this case, most maternal and child data generated within the rural communities remain invisible as the data is not collected regularly by HSAs and fed into HMIS. This is so because the knowledge that can assist in identifying this data is ignored, the knowledge possessed by chiefs and other members of the communities is left untapped. Much as the local tacit knowledge is socialised and externalised [8] through observation as an apprentice, story telling and village meetings within the communities (traditional health sector), the same is not true across health sectors.

A workshop initiated by the African Center for Statistics (ACS) and the UN Statistics Division (UNSD) held in Tanzania in July 2009, termed this a “Scandal of Invisibility” because “many people in Africa and Asia are born and die without leaving a trace in any legal record or official statistics”. The participants of the workshop were of the opinion that “absence of reliable data for births, deaths and causes of death are at the root of this scandal of invisibility, which renders most of the world’s poor as unseen, unaccountable and hence uncounted” [31]. The “Scandal of Invisibility” is aggravated when decision-makers fail to recognize the usefulness of locally generated knowledge in curbing the problem of invisible or missed data within communities. Lack of sharing of the locally generated knowledge is the root of this scandal.

Sharing knowledge requires interaction; whilst knowledge that is explicit in nature can be shared in writing, tacit knowledge needs externalization through storytelling, conversation, coaching, apprenticeship-observation and imitation [32]. Other than enhancing *sharing* of know-how, knowledge externalization *empowers* individuals as they learn to articulate what they know to other people. This allows for people from traditionally excluded groups to be included in decision making which is an empowering approach to participation [33]. In this case, knowledge from TBAs can be made explicit and be included in decision making and trainings. Once communities are empowered in participation and sharing knowledge, they can also develop a culture of sharing data which they generate. This is critical to ensure that data generated through traditional health providers is also captured into HMIS.

The analysis also illustrates the presence of local knowledge which is both tacit and explicit in nature within the Malawi health sector. Conklin [34] advocate that organizations need to remember “decisions and the knowledge surrounding them” (p.33); to do that there is need to learn how to capture the decision and the rationale behind it [34]. Health facilities in this study were able to capture the decision that collecting population data using head-counts would give them more accurate figures. The rationale being that with accurate figures, they will be able to order enough supplies (avoid shortages and wastages). This knowledge is useful for planning. Through the interactions, HSAs know the village set up and over time, they can easily notice if some of the community members were absent during head counts. In this case, HSAs use their locally generated knowledge and converts it into explicit knowledge in the form of head-counted population figures. That knowledge enables them to have more accurate figures when ordering supplies for their populations.

Although untrained TBAs have never been recognized by the health sector, the birth data they generate is essential to planning. They may also have some knowledge that if made explicit and shared, can help the trained TBAs. Local knowledge that is tacit in nature is reflected within communities by TBAs, where the TBAs pass on their skills to their children by observation. Through socialization between mothers and daughters, the skill of assisting in delivering births is passed on (from mother to daughter). Whilst the local knowledge generated by HSAs is codified and shared, the local knowledge possessed by TBAs remains unconverted. Such knowledge if properly externalized, documented and shared can help other TBAs who encounter similar problems. The process of externalizing knowledge empowers community and they also learn the benefits of making data they generate visible. As the documented knowledge is generated, the same conduits would be used to communicate the data produced.

Much as there is a clear indication that the local knowledge generated can be both tacit and explicit in nature, there are some variations amongst the three groups of HSAs, TBAs, and Enumerators. HSAs knowledge is shared as they convert what they see and hear into written form. Enumerators use combination process as they transfer what is explicit in the health passport onto the forms. For the TBAs, knowledge sharing is mostly through the process of socialization as what they do is converted into what others see; and they go through the process of externalization when what they do and what is seen is converted into written form.

Handzic and Tolhurst [35] identified oral and written as two main knowledge sharing systems and oral as being closely associated with knowledge that is tacit in nature. In the communities, knowledge sharing is done orally and informally because of the oral culture. This makes the categorization of knowledge as formal and informal [36] more appropriate. Once an organization recognizes the significance of the informal knowledge and manage it appropriately, they have the key raw ingredients to improving data quality.

Brown and Duguid [25] suggest that knowledge can be both a source of innovation, and a barrier to innovations, we have a situation in our case where innovative way of creating knowledge in the domain of HSAs in form of the head counted population creates some tension and inconsistencies in the health sector as some coordinators may use it whilst others do not. In addition, tension between trained and untrained TBAs as they compete for clients also create barriers to knowledge sharing. On the other hand, the findings are in accordance to what Puri [21] articulated, “Work practices that are not part of organizational rules and routines may reflect knowledge that is useful to the organization”. This is evidenced on how the head count population is useful at health facility level, and how the TBAs tacit knowledge assists them during deliveries.

Although the health sector as an organization has all the data needed to produce information for decision making, the contradiction of the data source is not visible. This lack of knowledge about the contradiction of data sources leads to a situation where the health sector uses less accurate information (projected NSO figures to distribute supplies), leaving out the head counted population figures that are more credible. The knowledge of this contradiction and utilization of the local knowledge generated at community and health level can improve the quality of data used in health system. Here the social status of where the knowledge is generated from come into play; since the NSO is the official institution, the data and knowledge from there is considered to be more credible than that from communities. Further, the knowledge possessed by the rural communities is overlooked, ignored [20] and considered less credible in this case as well.

The HSAs and TBAs live in the context where they are able to construct local knowledge that helps them understand the communities which they serve. However, the experiences and practices encountered within a context are not shared due to the organizational rules in place. We conclude that externalizing and sharing the local knowledge that reside within communities and specifically among traditional health providers can help externalize other human practices and make data generated within communities visible. Understanding the existing and emerging knowledge can lead to effective strategies to strengthen the health systems. MDGs four and five use maternal mortality ratio and under-five mortality rate as indicators; making data generated within communities visible would improve the MDGs indicators, otherwise better information and determinants of attaining health-related MDGs remain a challenge.

Although we use the Malawi health sector case, aspects of local knowledge not being shared are part of most organizations. These are more pronounced in cases where there is a dualism (formal/informal, rich/poor, modern/tradition, urban/rural) where one side is seen to be more superior to the other. Here NSO generated population data is seen to be more credible to the health facility generated data, despite the contradictions. Organizations need to go beyond the social status and utilize the local knowledge that is situated in the context where the relevant data reside to ensure that no data is missed. We cannot get right at a local level without the local knowledge which is the human capital.

7. SUMMARY TABLE

What was already known on the Topic	**What this study added to our knowledge**
Some data from local communities remain invisible and do not get to HIS	There is contradiction of data sources for the figures which are considered to be more credible
HIS is available from health facility level upwards and not at community level	Invisible data can be made visible if local knowledge is utilized
HIS uses population figures from national surveys to project denominators	Head-counted population figures are more accurate for denominator projections

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IV

Influence of Information Generated from Traditional Practices on Health Information Systems

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Abstract: A health sector in most developing countries comprises a dual legacy of traditional and modern providers. This necessitates that information from both sectors feed into their health information system (HIS). This paper analyses influence of information generated from traditional practices into HIS in a context where most of the population is assisted by traditional health providers. The paper draws on empirical findings from a developing country using a case of maternal and child health (MCH) information and describes why some information from traditional providers fail to find its way into HIS. The impact which the dual legacy of modern and traditional providers has on delivery of MCH services, achievement of the Millennium Development Goals and comprehensiveness of HIS is established. Community of practice (CoP) and chain of CoPs concepts are used to understand mechanisms that affect data collection and the way data flows from one level to the other in the health sector. We focus on community level where information is generated from traditional practices. We conclude that there is a weak link in the chain of CoPs between community and district level; causing most data generated from traditional practices to be missed.

Keywords: Community of Practice, Traditional Practices, Chain, Boundary Objects, Boundary Interactions

Influence of Information Generated from Traditional Practices on Health Information Systems

1. INTRODUCTION

A health sector in most developing countries comprises both traditional and modern health care providers, both of which generate information which could be of relevance to health information system (HIS). This dual legacy of traditional and modern health sectors necessitates that information from both sectors feed into HIS. However, problems may arise during implementation which may deter information systems (IS) from yielding desired outcomes. Implementation problems include: failure to collect all relevant data required by the IS from all possible sources; and other organizational issues. Successful implementation of HIS depends on whether data captured into the system is complete.

HIS in developing countries channel information almost exclusively from periphery level to central ministry headquarters. Most of the information is captured from patients who seek care at the lowest level-reporting facilities. This information is compiled on different forms for different services like outpatient care, immunization, and maternal care. The information is then aggregated on a weekly, monthly, or quarterly basis depending on the program and sent to the next level of reporting. Once it reaches the highest level, the information is used for planning and management. In some developing countries, particularly in the sub-Saharan Africa, health care planning and management is highly centralized, and its information base is weak (Oranga and Nordberg, 1997). Sources of data are usually vital statistics, facility-based reports, and population projections based mostly on old census figures. Although the information provides general illness pattern, services provided and an account of resources output at reporting facilities, the picture in most cases is crude, incomplete and partly inaccurate as it mostly reflects problems of a relatively healthy urban minority with easy access to health institutions (ibid.). Information generated from levels lower than reporting facilities where there are no proper mechanisms for data collection and reporting is left outside the loop.

This paper analyzes influence of information generated from traditional health practices on HIS. Considering that information generated by traditional health providers may or may not find its way into HIS. We describe limitations why information on traditional practices is not included in HIS and implications which omission or inclusion of such information has on delivery of mother and child health (MCH) services, achievement of Millennium Development Goals (MDGs) four and five, and comprehensiveness of HIS. MDG four and five are specific to improving child and maternal health respectively. The High Level Forum on achieving the health MDGs identified weak IS as one of the major shortfalls in the health sector (WHO, 2004). Strong HIS is a necessary ingredient towards attainment of the MDGs. We place much emphasis on traditional health practices and explore the following questions:

How can traditional health practices within communities be utilized to strengthen community-based HIS?

How can better utilization of health information from traditional practices improve data quality and health care management?

To understand the nuances of health information flows from community to higher levels, concepts of CoP have been used. A special focus is on community level where information is generated from traditional practices. We propose involving community members and strengthening village CoPs and making all forms of boundary interactions and objects (oral, hand written or electronic) visible. The process of strengthening the village CoPs will enable members to be empowered as they learn ways of participating in a group. Speaking with one voice as a group, their voice can be heard, and utilized; and their needs met. The paper draws on empirical findings from a developing country called Malawi using the case of MCH information with special focus on the traditional practices by traditional health providers. The paper emphasizes Noir and Walsham (2007) analysis that implementation of IS in health sector without a critical review of the way its cCoPs operate remain mythical and ceremonial. They give an example of how ICT implementation was used just as a way of legitimizing ICT for development where an IS was implemented as prescribed by and conforming to government rules. Technical purpose of the IS and how it can benefit marginalized communities was disregarded (Noir and Walsham, 2007).

The paper uses three stories to describe contributions and influence of information generated from traditional practices in the Malawi health sector. The Malawi HIS is called Health Management Information System (HMIS). The extent that traditional health providers can support and enhance comprehensiveness of HMIS is also discussed. The paper suggests that data on traditional health practices can be drawn upon to inform planning and policies on MCH services. This data is crucial as in most developing countries context, a good proportion of the population do not have access to modern health care.

2. INFORMATION SYSTEMS IN HEALTH

Most HMIS have mechanisms for collecting and reporting data from health facilities, these are more developed and the data available is well organized. Other information is collected through centrally planned national household surveys (Oranga and Nordberg, 1997). HMIS concentrate on comprehensive information and are continuous as they are routine systems integrated into day to day service provision (Koot, 2005). Oranga and Nordberg (1997) categorize HMIS into two types namely: 1) Facility-based health management IS (FBHMIS) and 2) Community-based health management IS (CBHMIS). The distinctions between the two have been illustrated in table 1. Unlike Thailand which has CBHMIS and an extensive network of community health workers collecting and using information (RHINO, 2006), most countries do not have CBHMIS.

	Facility-based HMIS	Community-based HMIS
Definition	a system of generating information originating from health facilities such as hospitals, health centers and dispensaries, private clinics and other NGO health activities	a system that generates information through sources at the community level
Scope	Limited: covers a special group consisting of health care seeking clients who are to visit or pay for the services	Comprehensive: covers all those members of the population who are poor or without access to modern health care
Use	Collects, aggregates, processes and monitors routine patient data	Monitors illness conditions that are either mild or too culturally stigmatized to be reported at health facilities
Strengths and weaknesses	Provision of reports	Action-oriented at community level
	Mechanisms for capturing data well developed	Lacks structured mechanisms for collecting data from households

Table 1- Facility-based vs. Community-based HMIS

In most cases, community-based HMIS are part of a larger programme where communities take ownership (Koot, 2005). Desired outcome of HMIS, regardless of type is to build a knowledge base that can guide decision makers in planning and health resource allocation.

3. COMMUNITIES OF PRACTICE

A CoP is characterized by three dimensions: domain, community, and practice (Wenger, 1998). CoPs have sense of purpose, a real need to share experiences defined by knowledge, and a life cycle which is determined by the value it creates for its members (Allee, 2000). Within a CoP, organization is around domain of knowledge that brings members together. As members identify with the domain of knowledge and shared understanding of their situation, an urge to work together and know what others know increases (Allee, 2000, Wenger, 1998). People function as a community through relationships which they build as a social entity, when they interact in joint activities. They build capabilities in their practices by sharing experiences and resources "that embody the accumulated knowledge of the community" (Allee, 2000). According to Puri (2007), practice is an interpretive scheme that community members draw upon to manage their day to day activities. In CoPs, members participate more on a voluntary basis as they personally identify with the course (Allee, 2000). A CoP has a sense of mission and continually redefines itself to suit the situation (ibid.) and “provides vehicles for leveraging tacit knowledge” (Antony et al., 2009).

CoP as a concept provides a new lens at the way organizations manage their knowledge. Instead of focusing narrowly on IS alone, they have a wide focus that includes people and available social structures, enabling organizations knowledge to live in the “constellation of CoPs” (Wenger, 2008). What is distinct in each CoP is its internal configuration, which results from its mission. Organizations with several CoPs need to pass on accumulated knowledge of each community to other CoPs. CoPs interact in various ways across their boundaries (edges). These boundaries are fluid and offer new learning opportunities different from the ones offered by communities as competences and experiences diverge (Wenger, 2000). Boundaries bridge via boundary objects, boundary interactions, or by brokering (ibid.). The boundary objects are transformed as they are passed from one CoP to the other, and have shared knowledge resident in them (Puri, 2007). A boundary object can be passed from CoPs in a community to health facility level; based on that, a new boundary object is created in the health facility CoP.

Health data flows from health facilities through district administration to national level. The CoP concept can be used to describe what happens at each of these levels when data is received and delivered as boundary objects, and building of knowledge within each unit when interacting with boundary objects. Since the building of knowledge at all levels is the aim of HMIS, the CoP theory is appropriate. However, CoP literature does not provide concepts for flow of boundary objects through several communities. Since this flow is an essential aspect of HMIS, we use the concept of a chain to characterize the flow. This concept was used as a theoretical lens to analyze how data flows through Organizations (Kanjo and Kaasbøll, 2009). The idea of a chain is that it connects several nodes, and when used in relation to CoP theory, each community can be seen as a node. Looking at the data flow as a chain enables identification of weaker links in the flow of data between CoPs. A chain’s strength depends on its weakest link. We will use missing data as an indicator of weakness in links, and although it has not been necessary to quantify missing data in this paper, such measurements could be done.

An organization is efficient only if all sub-systems are performing well and like a chain, the most unreliable sub-system can cause the whole system to fail. In HMIS, the purpose of passing on boundary objects is to inform each other and produce relevant information for planning at the highest level, and weak links between CoPs can weaken the whole process. Understanding the way each CoPs generates and stores data before it is passed to the next level is crucial and provides insight into causes that may weaken the links between CoPs.

Some CoPs interact via brokers, who are peripheral members of two or more CoPs (Cobb, et al., 2003), and can introduce parts of practice from one CoP to the other (Wenger, 2000). For example, a community health worker living in a community and also working in a health facility could be a broker between the two CoPs by discussing the community information with health personnel in the facilities. To be able to negotiate, translate and mediate between CoPs; brokers need to be abreast with the way issues are handled and expressed in both CoPs.

4. TRADITIONAL PRACTICES IN THE HEALTH SECTOR

Many developing countries use traditional health practices to meet their health care needs. In Africa, up to 80% of the population use traditional medicine for primary health care (WHO, 2008). Coincidentally, Malawi’s traditional health sector is also reported to provide up to 80% of the health care (Lwanda, 2002 after Msukwa, 1981). Even in cases where one has access to modern health care, others combine with the use of traditional practices. Traditional health practices include use of traditional healers and sTBAs. Large numbers of TBAs are present in rural areas. In this paper’s context, traditional practices include delivering of babies and attending antenatal care at a TBA. TBAs usually adopt their skills by observing what their parents and other elders in their villages are doing. The observations, coupled with need and demand from pregnant women within their localities push them into offering the service.

Traditional like modern health providers, have their own prescribed and accepted practices and many people depend on them. Globally, those using traditional practices are struggling to make their voices heard. Conceptual challenges come into play as policy makers and communities do not have same idea as to why TBAs are important. Whilst policy makers see them as the problem, communities see them as the solution. “TBAs are an important source of maternal care especially in rural areas”… and “utilization levels of TBAs are far much greater than presently acknowledged” (Bisika, 2008). Asghar (1999) also stressed the importance of using the potential which lies within communities for providing basic health care as a way of improving communities’ capacity for serving themselves.

Currently community health workers which are locally referred to as health surveillance assistants (HSAs) are the only link between the traditional and modern health sector.

5. METHODOLOGY AND METHODS

The research uses an interpretative philosophy with qualitative data analysis. Qualitative was chosen as people and their practices were the main focus of the study (Walliman, 2006) and most of the information was interpreted from the descriptions, accounts, and opinions (ibid.). The approach allowed for in-depth interviews and a chance to probe for more information where necessary. Data was collected from TBAs, mothers of babies under 2 years, chiefs, HSAs - these are community health workers who collect data from communities, enumerators, national statistics officer, health personnel at health facility, district and national levels as shown in table 2.

Cadre interviewed	**Number**
Traditional birth attendant (TBA)	7
Mothers of babies under 2 years	70
Health surveillance assistant (HSA)	7
Chief	2
Enumerator	1
National Statistics officer	1
Health facility personnel	6
District health office personnel	3
Ministry of Health HQs personnel	2
Focus group discussions	3
Total	**102**

Table 2 – Individuals and groups interviewed

Data collection was done during the period of January 2008 to July 2010 using unstructured and interactive interviews using a question guide. In order to gain complete information on facts, behavior, beliefs and attitudes of those involved with traditional health practices and the influence on HMIS, all of Kvale’s (1996) types of questions (which include direct, indirect, probing, interpretive etc.) were used during the interviews. The interviewees gave subjective accounts of the way they understand the situation and meanings were constructed from these responses. Informal discussions after the interviews proved to be a very rich source of accurate accounts of the situation at hand without reservations. In addition, observation was used. In some cases respondents would give accounts of the way things are supposed to be done, not what they actually practice. Observing them in their daily environments of work and within their communities enriched the understanding of their practices.

The findings are presented in a form of stories for two reasons: i) they are meant for a wide range of audiences from policy makers to collegial audiences. While collegial audiences can absorb at an abstract level, “other audiences respond more to stories … with descriptive narrative to make them interesting” (Corbin and Strauss, 2008), and ii) each storyline presents an opportunity to give a more complete and nuanced way of following up a baby from birth, where the baby is delivered, whether or not the baby receives vaccination, and therefore, whether the baby’s statistics are included.

The three stories that follow are constituted from the research findings.

6. CASES OF TRADITIONAL PRACTICES

6.1. Mwayi's Case

In 2006 Mwayi was living and working in Zomba when she became pregnant with her second born child. Like her first pregnancy, she was attending antenatal clinic at Matale health facility since her first trimester. On her due date, Mwayi left early in the morning for the clinic. Her baby was born during the night. Unlike her first born baby's case where she was assisted by a nurse and details of the baby were recorded; this time Mwayi was assisted by a cleaner as the nurse on duty was busy attending to other cases. Although Mwayi delivered a bouncing baby girl, the cleaner did not record details of her baby in the maternal register as she was hoping that the nurse was going to do it later. Recording of data in the registers is the mandate of trained health personnel (doctors, nurses, clinical officers, laboratory technicians...) who are also responsible for aggregating recorded data when compiling reports.

6.2. Edna's Case

One of the most common beliefs within communities in most Malawi rural areas is that TBAs are more caring when it comes to assisting a pregnant woman who is due for delivery. Edna had the same belief, and when she was due for delivery, she did not hesitate to go to Mai Mato, the TBA who has won the hearts of many. Although Piri health facility was within Edna's reach, she opted to deliver at the TBA. Both Edna and Mai Mato were aware that TBAs had been stopped from conducting deliveries. For Mai Mato, stopping the trade of assisting mothers deliver babies meant losing her only source of income. Before they were stopped from practicing, she would get MK300 (an equivalent of $2.10) for each delivery. In Mai Mato's village, a committee was formed to promote awareness to all pregnant women to go to health facility on time when they are due. Members of the committee included TBAs, chiefs and two representatives from each participating village. HSAs for the community are also peripheral members. They even set *chindapusa* (penalty) to be paid if a mother defaults advice. The *chindapusa* was in a form of a goat or chicken or MK500 ($3.50) paid to the village head (chief). Both Edna and Mai Mato were aware of the consequences. However, Edna had already made up her mind that she would rather deliver her baby at Mai Mato's place than go to Piri health facility where many women were waiting and some were being delivered by cleaners not the much publicized skilled birth attendants (SBAs). Edna did not want to add to statistics of institutional delivery when in actual fact it would have been "birth by institutional attendance".

The other risk was – what if the chief gets to know about it? By this time, Mai Mato was aware that the chief also did not mind a chicken for a meal, let alone a goat or being MK500 richer. Besides, by the time Edna arrived at Mai Mato's place her labor pains were already advanced. She could not send her back to the health facility for fear of risking baby's life. Mai Mato's only hope was that after being assisted, Edna would go for check up at Piri health facility and have the baby immunized. As it turned out, not only did Edna not believe in being assisted by SBAs at a health facility, she also did not believe in having her baby immunized. "My baby will get sick with vaccination", she said; and instead she used traditional protection for her baby such as the ones shown in the pictures below.

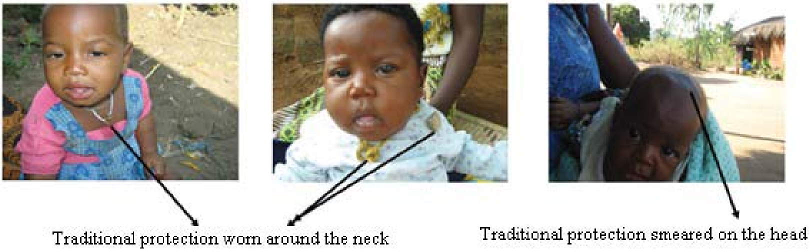

Figure 1– Traditional protection used on babies

Mai Mato informed Edna that this time she will not record details of her baby in her birth register (see figure 4) as she has since stopped recording. Although Edna did not mention to Mai Mato, she did not go for the said check up or immunization. Fortunately for her, both the baby and she did not have any complications. The HSA who collects recorded data by the TBAs from that community did not know about Edna's baby's birth as Mai Mato did not record it, and he had not surveilled that village that week.

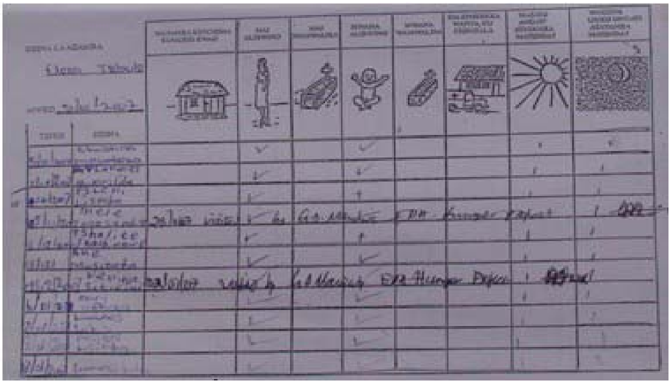

Figure 2 - TBA Births Register

6.3. Chifundo's Case

They arrived by foot at the TBAs place in the early hours of the night, two of them, Chifundo and her grandmother. The TBA, Mai Leni, who had already received instructions to send all pregnant women to a health facility, had no choice but to assist Chifundo since the health facility was more than 10 kms away. During the day it had rained heavily. The dirt road to the health facility was muddy and slippery due to the heavy rains. That also made it difficult for Chifundo and her grandmother to continue their journey to Ngwe health facility. Besides, not only did Chifundo lack transportation, she also did not have all the requirements which she had been advised to bring with her to the health facility once she is due. Mai Leni was woken up; she received Chifundo and her grandmother and asked them to go into the house which was being used as a maternity room the time she was practicing. She remembered Chifundo from last time when she assisted her during the birth of her second born. Those days Mai Leni used to have many clients from the neighboring villages. Her place was like a health post as the only health facility was very far specially for heavily pregnant women.

Although the TBA did not record Chifundo and her baby's details, she advised her to go for check up and have the baby vaccinated at Ngwe health facility. Within the week, Chifundo reported at the health facility and was advised when to bring the baby for the first vaccination. Chifundo's baby's details were entered in her new health passport (book). Although this was Chifundo's third born child, her health records had entry for this baby only as the previous two were born at a TBA. The statistics were also not recorded in the village health register as it is kept by the HSA.

7. ANALYSIS AND DISCUSSION

The three stories narrated give a clear indication that both traditional and modern health care providers generate information which is relevant to HMIS. This dual legacy of traditional and modern health sectors necessitates that well structured mechanisms for collecting data be put in place in both sectors. The data presented above suggest that there is need to go beyond the discourse that suggests that there is a choice to make in developing countries between modern and traditional health providers. In all stories, there are elements that limit a pregnant woman to have modern health provider as a choice. In the first story, although Mwayi went to a health facility on time, she ended up not being assisted by trained health personnel due to circumstances and was not sure whether her baby's statistics were recorded. In the second story, Edna is not keen to go to Piri health facility where many women will be waiting unattended or being attended by cleaners who have less experience than the TBA. The only advantage would be that statistics of her baby would be captured in the system had she opted for this route. In the third story, much as Chifundo wanted to have her baby delivered at a health facility, access was a problem twofold: means to get to the health facility quickly at night without enough resources, and long distance to the health facility. In most rural parts of Malawi where Edna and Chifundo live, there is inadequate numbers and inequitable distribution of health facilities. In this situation, a facility-based HMIS captures mostly information relating to only a small proportion of the population – those with access. In the case of Malawi, over 80% of the population live in rural areas where health facilities are far apart.

7.1. The Need for Community-Based HMIS

Koot (2005) articulated that there are few and isolated community-owned data collection systems and that in most cases; the CBHMIS are part of a larger programme where communities take ownership. Here the graph is asymmetry. We have a situation where more FBHMIS cater for less proportion of the population and few and isolated CBHMIS have a large population to take care of. For example, in Malawi, the health facility population ratio in rural areas is almost double that of urban areas with an average per facility of 9,870 people in urban areas and 14,749 in the rural areas. Edna's story confirms the "Scandal of Invisibility" (ASJ, 2009), where her baby was born and there was no legal record of the baby's birth.

Where CBHMIS are part of a larger programme or a larger HMIS, it is necessary to devise proper and consistent mechanisms of capturing data from communities. A number of researchers (Koot, 2005; Lippeveld et al. 2000, and others) have discussed how important data and information on births and deaths is. It is the cornerstone of public health planning. When such data go uncounted and the causes of death are not documented, governments cannot design effective public health policies or measure their impact (WHO, 2007). From literature and the stories, the importance of capturing data at the point where it is generated cannot be ignored. As time pass before the data is captured, it can be forgotten or cultural aspects come into play where some people may not feel comfortable talking about death. If this happen, and data collection rely mainly on data from national surveys, then HMIS risk missing a lot of data from communities.

7.2. Traditional Practices and HMIS

In addressing the issue of improving implementation of HMIS, it is important to note that going to health facility for delivery, or check up, or to immunize a baby can be limited by i) choice or ii) circumstances. If the mother is not willing to go, as in Edna's case, the data generated through traditional practices does not find its way into HMIS. In Chifundo's case, if she had not gone for check up at a health facility, her baby's statistics would not have been captured. TBAs also play a crucial role in the implementation of HMIS. Once the data of the deliveries which they assist is not recorded, that data is easily missed if the mother does not go for check up and immunization. However, if TBAs include data recording in their practices, the data can find its way into HMIS through HSAs. In a study conducted by Byrne and Sahay (2007) where they looked at role of participation in a community-based child health IS in rural South Africa; it was revealed that in IS, there is need to involve not only the users of the IS, but also those individuals who are affected by the IS, even when those individuals have no direct interaction with the system. TBAs and mothers will not have interactions with HMIS yet their practices affect the data that is fed into HMIS.

7.3. CoPs in the Health Sector

The health sector has various levels and different types of CoPs; each containing many instances. CoPs within the health sector can broadly be categorized into two types: one comprising members who practice traditional medicine, and the second comprising members practicing modern medicine as members of these two groups often meet and share their experiences. However, the focus of this paper is not to understand the practices in broad categories, rather we aim at understanding how data flows from community level (center of traditional practices) to the highest level and the way it is transformed by different CoPs which the data interact with. Using the stories above and background information of a health sector (Lippeveld at al., 2000; Chaulagai et al., 2005), three levels (community, district, and national) have been identified within the Malawi health sector. In addition, we have identified five different types of CoPs namely: *village committee, health surveillance assistants (HSA), trained health personnel, coordinators*, and *policy makers* (see figure 3). The five CoPs identified are not exhaustive, but will assist in explaining the concept of chain of CoPs. For the discussion, we look at one vertical slice of each of the five types of CoPs.

Since CoPs have a sense of mission, each of the CoPs identified have their purpose. In the second story for example, *village committee* CoP comprising TBAs, chiefs, HSAs and two representatives from each participating village is described. This CoP was created with a purpose of advising pregnant women to go to health facilities for delivery as a way of improving MCH. These members had a real need to share their experiences and knowledge to pregnant women in their villages, advising them to deliver at a health facility. This CoP belongs to the community level. A second CoP comprises of *HSAs*, these share their experiences from the different CoPs each of them interact with. HSAs CoP cuts across community and district levels; and its members also belong to two other CoPs which it interacts with. Like a link in a chain, this CoP also acts as a link between the two broad CoPs (the traditional and modern health providers). *Coordinators is* the fourth CoP comprising district health officers, health program coordinators, and HMIS Statisticians. The fifth CoP is that of *policy makers*. Each of these CoPs has common practices and purpose that bring them together and as articulated by Allee (2000), they continually redefine their form to suit the current situation. For example, the village committee CoP redefined their form by adding follow up activities for pregnant women to ensure that they deliver at health facilities and charging the defaulters *chindapusa*, in addition to their advisory role. As CoPs also leverage tacit knowledge (Antony et al., 2009), the village committee had leveraged knowledge of the behavior of community members they assist.

Much as they have a mission, there are cases where CoPs can lose their sense of volunteerism. An example here is a situation where a village committee CoP charges *chindapusa* and it is not paid. The CoP can easily lose trust in the system which they have invested their time in. On the other hand, a CoP can have the urge to forge ahead if they are motivated. An example here is the *HSA* CoP. Although this CoP is overburdened with tasks, they are motivated to go on because of the respect they get from communities they serve. The community members refer to them as *a Dokotala* a term locally used to refer to a professional health personnel like a doctor or a nurse. That gives them a strong urge to continue serving the community due to the clout they command. The situation which a CoP is operating in can therefore make or break it.

As the health sector comprise several CoPs, it is important that information generated in one CoP is passed to the other. In the case of the Malawi health sector, information is passed using different forms of boundary objects or interactions from one level and CoP to the other; and brokering by HSAs is used between village committee and health facility CoP. The purpose of passing on these boundary objects is to inform each other and produce relevant knowledge of health information for planning at the highest level. If the CoPs identified in the health sector do not share the data they generate or if weak links exist between CoPs this can weaken the whole process and CoPs collective mission cannot be achieved.

Figure 3 illustrates the different boundary objects that link CoPs. *Village committee* CoP is linked to *HSA* CoP via three boundary objects namely: antenatal care reports, birth registers, and village visits reports. Much as the birth registers and antenatal care reports are formal, the village visits reports are informal, improvised by the village committee. These are transformed into monthly inspection reports and village health registers as they link *HSA* to the *trained health personnel* CoPs. At this link, the monthly inspection reports are also improvised and informal. Facility reports links *trained health personnel* with *coordinators* CoP and finally, aggregated reports link *coordinators* with *policy makers* CoP. At each level, the boundary objects are transformed from one type of report to the other. These boundary objects form a link which bonds the CoPs into one chain.

Antony, et al. (2009) express that ways in which each CoP constitute and express their knowledge needs to be understood. In addition, it is important to understand the way different CoPs interact and how data is transformed from one community to the other. The Malawi health sector illustrates how different CoPs interact, with the boundary objects acting as the links that hold a chain of CoPs. This can also apply in CoPs in other sectors. In any situation, a chain of CoPs created is as strong as its weakest link.

The second story narrated above give a good example of weakest link in a chain of CoPs; the boundary objects used to link the *village committee* and *HSA* CoP are not operational as TBAs no longer record data due to change in policy. This makes this link the weakest. Further, one of the boundary objects linking the *HSA* and *trained health personnel* CoP is not fully functional, and that link is also weak. Both CoPs with weak links are at community level, this also provide a weak link between traditional and modern health providers, a situation that leads to most of the data generated from traditional practices not finding its way into HMIS.

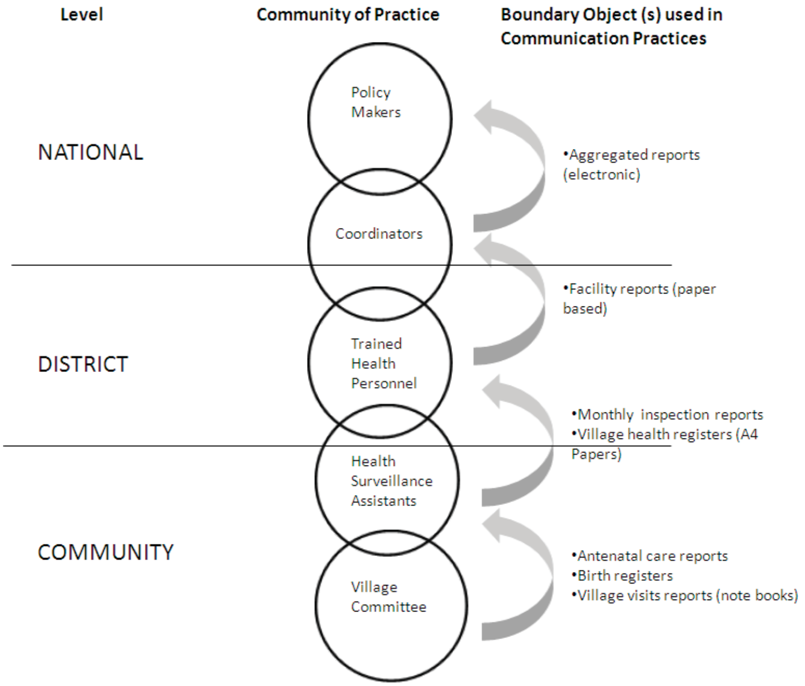

Figure 3 – CoPs within the Malawi Health Sector

With the 80/20 rural urban population ratio, and the fact that a good number (NSO-WMS, 2008; pp. 26) of pregnant women, particularly in rural areas, prefer to deliver their babies at TBAs, completeness of data feeding into HMIS is affected as evidenced in Edna's story. The missing information from traditional practices may have a negative influence on comprehensiveness of HMIS for planning, decision making and policy implementation. Further, excluded data from part of 80% of population may translate into a large number of missed data. This may derail the attainment of fourth and fifth MDGs as planning is based on information that does not reflect the situation on the ground.

8. CONCLUSION

Most of the data generated from traditional practices does not find its way into HMIS due to the weak link existing between the community and district levels. This is a result of lack of mechanisms for data collection at community level since TBAs stopped recording data due to change in policy. The missing data from the traditional practices means excluding most data from 80% of the population. The missed data may affect completeness of HMIS, This may derail the attainment of fourth and fifth MDGs as planning and decision making is based on information that does not reflect situation on the ground.

The paper has emphasized that implementation of IS in health care system without a clear understanding of CoPs remain mythical and ceremonial as articulated by Noir and Walsham (2007). Further, we conclude that to make sense of the way data flows from one CoP to the other, there is need to understand mechanisms that link the CoPs. To establish the links between CoPs, we have introduced the concept of chain of CoPs. We conclude that there is a weak link in the chain of CoPs between the community and district level; causing most data generated from traditional practices to be missed.

In the developing countries weak links in chains of CoPs may apply particularly in contexts where there is interplay of traditional and modern practices. The mode of communication in these contexts could be oral, hand written papers or electronic. The hand written papers and electronic messages are boundary objects;

on the other hand, oral messages are boundary interactions. Within the traditional health sector, only boundary interactions exist. In the modern health sector, both boundary objects and interactions are used. Where boundary interactions (oral messages) only are used, the links are weaker, therefore, CoPs that communicate using boundary interactions (orally) are considered to be weaker links. In figure 3, the weakest link is between village committee and health facility CoP since TBAs no longer record data. We propose the need to capture data passed by all forms be it oral, hand written, or electronic within different CoPs.

We have highlighted weak areas and how health information from traditional practices can be better utilized by strengthening CoPs in order to improve health data quality and health care management – a necessary ingredient towards attainment of MDGs. In strengthening the CoPs, members increase their participation and interactions and they become more empowered as there is strength in numbers; they can be able to articulate their health needs with one voice. This helps to make data created within their communities more visible through interactions within and across CoPs. This can enhance development. Much as an example from Malawi, a developing country, has been used, community empowerment is necessary in all underserved and disadvantaged settings across the globe.

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IV

STRENGTHENING THE LINK BETWEEN TRADITIONAL AND MODERN PRACTICES FOR IMPROVING DATA QUALITY IN HEALTH INFORMATION SYSTEMS: THE CASE OF MALAWI

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ABSTRACT

This paper describes an empirical qualitative analysis of how knowledge and data generated through traditional health practices, specifically by traditional birth attendants, with respect to maternal and child health, define and control data quality in health information system. The aim is to gain an understanding of how knowledge and data crosses the boundary between traditional and modern sectors with varying practices, and how the existing mechanisms linking the two sectors can be strengthened. Using an interpretative approach, this research provides the health informatics and information systems community with an understanding of how bridging the divide between scientific and indigenious knowledge can improve data quality in a context where two different sectors exist; each utilising different types of knowledge. Concepts from community of practice theory were employed as the framework for analysis. We recommend that boundary crossing of knowledge and data between the two health sectors must be tailored from histrorical, cultural and modern perspectives, with an emphasis on: i) utilizing the historical-cultural means of capturing data through chiefs and ii) the modern mechanisms of utilising health surveillance assistants as the link.

Keywords: data quality, indigenous knowledge, traditional practices, knowledge brokers, health information systems

1. INTRODUCTION

Dissatisfaction with health information systems (HIS) data quality is pervasive (Mettler et al., 2008; WHO, 2003). A contributing factor is the fact that health sectors in most developing countries have two components with varying characteristics and practices – modern and traditional sector, and health data is distributed amongst different providers from these sectors. In addition, the different sectors utilise different types of knowledge. The modern health sector provides services to treat patients with curative, preventive, and palliative care and depends on interdisciplinary teams of professionally trained, paid personnel (WHO, 2011) who use modern/western medicine and practices (Stieg 2011) and facilities. This sector utilises scientific knowledge. The traditional health sector on the other hand do not involve professionally trained nurses or physicians, they are self-taught or informally trained, and mostly utilise indigenous knowledge. Their knowledge is often passed on verbally or otherwise from generation to generation, based on theories, beliefs and experiences used to maintain health in different cultures (Zhang, 2000; Juliá and Kondrat, 2005; Hills et al., 2006; WHO, 2011). Traditional health sector providers include traditional healers and traditional birth attendants. In Malawi, the only link existing between the two sectors are the community health workers known as health surveillance assistants (Kadzandira and Chilowa, 2001; Katsulukuta, 2010; Kanjo and Kaasboll, 2009). This study focused only on the traditional births attendants. These are part of the maternal and child health.

Evidence reveals that utilisation of traditional births attendants is common in rural communities both in Malawi and other developing countries (Bisika, 2008; Gorjestani, 2000; Izgubura et al., 2008; Makumbi, 2009; Yousuf et al., 2010). This implies that a substantial amount of maternal and child health data is generated through traditional practices. Yet knowledge utilisation and data collection mechanisms differ significantly between traditional and modern health sectors.. Most health reform initiatives concentrate only in the modern health sector (c.f. Reich, 1995; 2002) although both health sectors provide primary health care to the population (Mosse, 2004). In Malawi, evidence exists that the existing link between the two health sectors - that of the health surveillance assistants - is weak (Kanjo, 2011). The weak linkages between the two health sectors are compounded by the fact that indigenous knowledge is historically marginalised from the modern scientific community (Puri and Sahay, 2003). This in turn leads to poor data flow from traditional to modern health sector, and compromises HIS data quality.

This paper aims at extending initiatives of integrating the two types of knowledge used in the two health sectors and strengthening the link between the two health sectors. The following research question will be addressed: *How can the link between traditional and modern health sector be strengthened to ensure consistent flow of knowledge, information, and data across sectors*? Community of practice theory concepts were employed as the framework for analysis. The focus is only on maternal and child health data, and in the rest of the paper traditional health providers is used synonymous to traditional births attendants.

1.1 The Role of Traditional Providers in Health Systems

Traditional health providers are significant in developing countries because they are more accessible and affordable (WHO, 2003) and are more available than western-trained medical doctors (Hills et al., 2006) and are part of the community (Nelms and Gorski, 2006). In Africa, traditional health providers offer services to 80% of the population (Green, 1994; World Bank, 2011), whereas worldwide, traditional health providers offers services to more than 66% of the population (Nelms and Gorski, 2006). Although the World Health Organization (WHO) acknowledges the fact that traditional health providers utilize indigenous knowledge, skills, and practices based on the theories, beliefs, and experiences indigenous to their different cultures, most countries lack national policies for traditional health providers (WHO, 2008). Interestingly, even the elite have maintained the culture of utilising traditional providers and medical duality is evident in many developing countries (Lwanda, 2002; Oranga and Nordberg, 1997). Therefore traditional providers' potential should be harnessed as it is a private matter that people opt to utilise them (Rankopo, 1996). Shepherd et al. (2006) argue that leveraging both indigenous and modern/scientific modalities of the health care knowledge enhances improvements. On the other hand, Agrawal (2004) states that pressures of modernization and cultural homogenization cause indigenous knowledge to disappear, threaten the lifestyles, practices and cultures. Using the community of practice theory, we discuss how leveraging knowledge from both traditional and modern health sectors can assist in improving HIS data quality.

2. THEORETICAL PERSPECTIVES

HIS implementation in most developing countries have two major weaknesses. The first weakness is the asymmetrical nature of the initiatives in the two health sectors. As mentioned earlier, most HIS initiatives take place in the modern health sector (Reich, 1995; 2002). This sidelines the data generated in the traditional health sector and raises the challenge of how to best tap the knowledge and data generated within the traditional health sector. Secondly, the divide between scientific and indigenous knowledge (Puri and Sahay, 2003) poses a challenge in a sense that the two health sectors utilise different types of knowledge. The modern health sectors use scientific knowledge, whereas the traditional health sectors mostly use indigenous knowledge. In most cases, scientific programs and practices emphasize the superiority of scientific knowledge and the potential to integrate scientific and indeginous knowledge has failed in practice (Puri and Sahay, 2003). In HIS, the data is mostly captured from health facilities with the use of modern and scientific methods.

Theoretical issues around knowledge generation, utilisation and brokering from communities of practice (Lave and Wenger, 1991; Wenger, 1998; Wenger et al., 2002) are discussed in the sections below. Community of practice theory was chosen because it helps in creating a social infrastructure that enables knowledge creation and transfer (Brown and Duguid, 1991; Lave and Wenger, 1991; Murty, 2011; Roberts, 2006). Within Communities of practice, people participate, share common concerns, experiences, and passion, whilst focusing on learning, building capability, and leveraging the knowledge created to solve problems (Murty, 2011). It is not sufficient to understand the practices within a community of practice; of extreme importance is ensuring that knowledge generated in one community of practice is transferred and transformed into another (Wenger, 1998; Yakhlef, 2007; Star and Griesemer, 1989). The communities of practice therefore provide a social container for linking knowledge producers (Hearn and White, 2009).

2.1 Knowledge and Data Cultivation within a Community of Practice

Corresponding to the two broad entities in the health sector (modern and traditional), the knowledge created is categorized into two: scientific and indigenous. According to Agrawal (1995), these two types of knowledge can be differentiated based on substantive, methodical and contextual themes. Substantively, indigenous knowledge is seen as concrete and closely tied to solutions offered by indigenous people whereas scientific knowledge is abstract and analytical. In terms of methods, indigenous knowledge is bound by structural constraints and closed, whereas scientific knowledge is open. Contextually, indigenous knowledge is embedded within a particular community compared to scientific knowledge which is universal (Agrawal, 1995). The distinction of knowledge into scientific and indigenous brings dichotomies into something which coexist (van der Velden, 2009); at the same time the diversity in knowledge types reflect the tension between the global and the local (Randeria, 2007). Regardless of its type, knowledge is 'created, shared, organized, revised, and passed on' (Wenger, 1998) by the sharing of experiences and interactions within the communities of practice. This then can enable indigenous knowledge to move from one community of practice to the other and integrate with the scientific knowledge.

Agrawal (2004) argues for recognition that knowledge always benefits different people and groups in different ways. We aim to have the knowledge generated within the traditional health sector utilized to benefit the planners and policy makers within the health sector. Incorporating indigenous knowledge and practices into development has been recommended in literature since the 1970s (Dekens, 2007). Despite these recommendations, a number of organizations have not taken any action to explore the contributions which indigenous knowledge bring. Partly its because of "whose knowledge counts?" as van der Velden (2009) asks or which knowledge counts? Although indigenous knowledge is a key element of the social capital within the local communities, Puri (2003) notes that indigenous knowledge is mostly undermined and undervalued compared to scientific knowledge. In the past, indigenous knowledge had no place in international development projects as the traditional practices were seen as obstructing development (Sillitoe, 1998). Now "the category of indigenous knowledge is added to the development discourse as a resource to improve development" (van der Velden, 2010). This turn of events - from obstructer of development to a resource to improve development, is a good example of how knowledge "evolves and changes as it develops" (Onwu and Mosimege, 2008).

The importance of indigenous knowledge is based on evidence where local communities have utilized it to solve problems. Examples abound: in public health, food security, and the preservation of biodiversity in Malawi (Chiotha, 2005); land settlements in Mozambique (Gorjestani, 2000); GIS implementation for land management in India (Puri, 2003); soil classification by farmers in Ethiopia (Fenta, 2006); and disaster management in the Himalayas (Dekens, 2007). Particularly important is a discussion of how recognizing indigenous knowledge as “a valuable resource within an organization” (Grant, 1996) can improve the flow of sticky knowledge. However, much of this knowledge has not been explored, and remains invisible. Local communities have turned to indigenous knowledge as a solution to their problems in a number of areas including public health, particularly in developing countries (Chiotha, 2005; Rosato et al., 2008). Although the modern and traditional health sectors are seen as separate entities; they are interconnected. The members and histories are shared across the two sectors. Indigenous knowledge is associated with the traditional health sector whereas the modern health sector is associated with scientific knowledge.

Knowledge and communities that create, use, and transform it are inseparable (Allee, 2000). Other than sharing knowledge generated, we are also interested in sharing the data generated. In community of practice, the link between learning and knowledge have been discussed and explained (Lave and Wenger, 1991; Wenger, 1998); however, the link between knowledge and data has been hardly discussed. Tuomi’s (1999) “reversed hierarchy of knowledge” arguments helps to articulate the link between knowledge and data within communities of practice. The generally accepted view is that data is a prerequisite for information, and information a prerequisite for knowledge (Davenport, 1997). Tuomi (1999) contests this conventional view arguing that the traditional hierarchy of data, information, and knowledge requires rethinking, and needs to be reconsidered (Tuomi, 1999). Tuomi argue that “data emerges only after we have information, and that information emerges only after we already have knowledge” and propose what they call “reversed hierarchy of knowledge”. Tuomi emphasizes that data do not exist without external reality that can guide its structure. Therefore, data emerges last—only after there is knowledge and information available. Tuomi (1999) illustrates this using a prototypical example from the domain of thermophysics, showing the contextual requirements for measurement of empirical data.

The illustration demostrate how important aspects of knowledge are required to come up with a thermometer as the measuring device for collecting data on temperature. Data, therefore, exists only after a pre-judgment is made; after a thermometer is created with the possibility to observe temperature as data. Tuomi further explains how several prominent philosophers of knowledge, like Bergson, James, Husserl, Heidegger, and Mead [c.f. Tuomi, 1999:p.5-10] “share the fundamental insight that the world as an object of human knowing exists only as an interpreted world that is completely infused with meaning”. The meaning is provided by the knowledge. Using Tuomi’s argument of “reversed hierarchy of knowledge”, I argue that the knowledge created in communities of practice assist in data creation within the community of practice. Therefore, by creating knowledge in the communities of practice, the knowledge helps to create data.

2.2 Brokering Across Communities of Practices in the Health Sector

The community of practice approach enables sharing of knowledge across boundaries. Much as most boundaries are fuzzy and not discernible to an outsider (Wenger et at., 2000; Puri and Sahay, 2003); the boundary between the modern and traditional health sector is quite distinct. Brokering is an important analytical tool to enhance sharing across all forms of boundaries within the health sector, specifically between modern and traditional sectors. In the health sector, the evidence of using traditional health providers is not reflected in the data that crosses boundaries into health information systems as the data collection mechanisms within the traditional sector remain elusive (Chaulagai et al., 2005). This contribute to poor data quality for monitoring health status and planning for relevant health-related interventions. Hence there is great need for more efficient methods of collecting health data from rural communities (Oranga and Nordberg, 1997) and strengthening the link between the two health sectors. Boundary connections are therefore essential to ensure strong links.

Boundary connections combine *participation* and *reification* (Wenger, 1998) and have been described in a slightly different ways by different scholars, but they retain the same meaning, what matters is that these connections facilitate knowledge sharing across different social worlds. Participation is an active process that involves both action and connection (Wenger, 1998; Wenger et al., 2002). Over time, members develop a body of common knowledge, practices, and approaches (Wenger et al., 2002). Through participation, diverse and complex practices converge through mixtures of power and dependence; expertise and helplessness; success and failure (Wenger, 1998). The notion of boundary objects have been categorised differently representing tangible and abstract by different authors as illustrated in Table 1 below.

Table 1

Author(s)	Tangible	Abstract
Star and Griesemer (1989)	concrete boundary objects	abstract boundary objects
Wenger (1998)	boundary objects	boundary interactions
Clegg et al. (2006)	boundary objects	discourses, processes

Star and Griesemer (1989) describe boundary objects as being either concrete or abstract. On the other hand, Wenger (1998) distinguishes them as boundary objects and boundary interactions, where objects are the tangible ones and interactions are the abstract ones. Clegg et al. (2006) included discourses and processes as being boundary objects. Wenger (1998) defines interactions as a form of members of a community of practice being immersed in the activities of another community of practice, or participating in practices that develop between two communities of practice (c.f. Wenger, 1998; p111-116). Wenger argues that these interactions need to be nurtured at points of CoPs intersection because not all CoPs produce boundary objects. According to Haraway (1988), the boundaries materialise in social interactions and are drawn by mapping practices.

Another way of interacting is through knowledge brokers. Knowledge brokers are intermediaries that mediate between sources of knowledge and users of knowledge (Campbell 2006). It is defined as “the disconnection – the missing link – between knowledge and action, between evidence and practice” (EAC Health, 2008), and between researchers and users of research results (Lomas, 2007; Ward et al., 2009). A knowledge broker provides a link for knowledge translation and exchange, builds rapport with target audiences, and forges new connections (Dobbins et al., 2009) between two communities of practice (Wenger, 1998). To be able to negotiate, translate and mediate between CoPs; brokers need to be abreast with the way issues are handled and expressed in both CoPs. People act as brokers between two CoPs, and such people are members to both CoPs. An example within the health sector is a community health worker who is a member of two CoPs; one CoP within a village where s/he works and the other CoP at a health facility. By belonging to two CoPs, a broker is able to infuse one CoP with knowledge from the other. Brokering involves process of translation, coordination, exchange, and alignment between perspectives and it promotes interaction.

Looking at a researcher and end user domains perspective, Dobbins et al., (2009) identify a number of abilities as necessary for a knowledge broker; ability to tailor the key messages, ability to use meaningful language, and ability to develop a trusting and positive relationship. Within the health sector, the end users can be policy makers (van Kammen, et al., 2006). What is more important is the fact that some evidence suggests that knowledge brokering can be effective in improving the quality in decision making (Dobbins et al., 2009) as the knowledge is shared to the other stakeholders.

Knowledge brokering is considered to be an emerging human resource in the health sector (Dobbins et al., 2009), and in some contexts, they have it as an established post. Brokerage approach has the power in accelerating a mutually satisfactory experience in connecting policy-makers to the required evidence (van Kammen et al., 2006). Wenger (1998) however, warns against the push and pull effect between brokers and communities of practice they are brokering: they must avoid being rejected (push) and becoming full members (pull). If rejected, the brokers risk a chance of tapping on the knowledge generated within a community of practice. On the other hand, if they become full members, then they may end up concentrating on one community of practice and not able to transfer the knowledge to other communities of practice which they may not be part of. Brokering helps to spread and make sense of the knowledge as it needs to be interpreted and digested properly in the contexts where it is used (Hearn and White, 2009).

3. RESEARCH METHOD

This paper is part of a research study that was conducted during the period June 2008 to July 2010 in three health catchment areas in one of the districts in Malawi. The broad research phenomena was - a good number of pregnant women deliver babies out of health facilities and there was need to establish whether this data finds its way into HIS. In the process of analysing this phenomena, it was established that there is a weak link between the two health sectors. For the present study, we analysed how best to strengthen this link. An interpretive paradigm using qualitative methods was adopted in the study. An interpretive epistemology was chosen as there was need to uncover the practices that leads to knowledge and data generation and how it is transferred from the traditional to the modern health sector.

The research used a case study with an interpretive approach (Walsham, 1995) to qualitative data analysis (Miles and Huberman, 1994). Case study research is known to be the most widely used qualitative research method in IS research as it enables better understanding of the interactions between the system and organizational context (Orlikowski and Baroudi, 1991; Darke et al., 1998). The case study method used in this study was based on interpretive (Myers, 1995) philosophy. An interpretive approach seeks to understand the complexity of human sense making in a constantly changing context, and assumes that the knowledge of reality is gained through social constructions (Nicholson and Sahay, 2004). With the interpretive approach, situations do not just exist; they are created when a researcher enters into the world and is part of that reality and is involved in coming up with meaning. Various views, interpretations, and meanings are assigned to events and a deeper understanding and root causes of the problems unfold. The interpretive approach provided insights of the way data and local knowledge are created within communities and shared across the health sector. Further, it enabled a good understanding of the interdependence that exists between the two health sectors and the existing link(s). This was done using qualitative methods which enables one to follow events and their consequences within a context (Miles and Huberman, 1994).

The qualitative method is well-grounded and provides rich descriptions and explanations of processes in local contexts as it is conducted through an intense and prolonged contact with the situation being studied (Miles and Huberman, 1994). In this case, community health workers (health surveillance assistants) who act as links between the two health sectors were studied; the way they interact with the community members, their frequency in collecting data, and where this data is collected was studied. The qualitative approach is open-ended, involved, and uses a small sample. This study conducted in three health catchment areas in Malawi (one urban, the other two rural) from one district. The Malawi health sector has four levels: ministry, district, health facility, and community level. The three health catchment areas represented both the health facility and community levels. In this case, the health facility level represents the modern health sector, where as the community level represents the traditional health sector. Although the breadth of the sample is not that big, it is the depth that matters because a researcher can *keep asking until there is nothing new*. In addition, this allows researchers to go beyond snapshots of *what* or *how many* to a different level of understanding of *how* and *why* things happen as they do and assess causality within the context (Cf. Miles and Huberman, 1994: p.10).

The study included representatives of the following health providers: mothers with babies (0 to 23 months of age), skilled and traditional birth attendants and women who assist in deliveries within the study area, coordinators of health facilities, and health surveillance assistants (HSAs). Clearance was sought from different places. Locally, permission to collect data at the study site was sought from the District Health Officer (DHO) of Zomba district, health facility personnel, and the Chiefs in the study area. The permission given by the chief was enough to be able to access traditional births attendants (TBAs), mothers of babies, and other members of the community for interviews and observation. All participants in the study were asked for consent before participating and a consent form which was in two languages (English and the local language Chichewa) was read to the participants. The researcher was familiar with two local languages spoken by the interviewees and this contributed to the social skills which Walsham (2006) mentions to be a requirement in interpretive research.

The research question(s) determined that the best way to obtain the information was to be engrossed in the context in which the traditional practices were occurring. I decided to observe people and events, analyze documents and literature, interview, conduct focus groups discussions, and talk to people informally. For the interviews, data was collected using a combination of field notes, video and digital camera, and audio. Observations helped to understand the invisible work (Bardram and Bossen, 2005). If we base our judgment on what man says only; we have not looked deep enough (unknown). Much as this was a qualitative research, some guiding data collection tools were devised to make sure that data collected or observed relates to the research questions and is consistent for each group of stakeholders. These tools consisted of interview guides for health surveillance assistants, traditional births attendants, village chiefs, and mothers of babies whose data was collected. The interview guides for the TBAs, chiefs and mothers were in both English and Chichewa (local) languages.

The sample size was not predetermined; data collection was stopped when the findings had formed some trends and themes which were repeating. The mix of data collection methods allowed for triangulation of the findings, as what people say they do is not necessarily what they actually do. Observations helped to verify this. Here observation involved the systematic recording of observable phenomena or behavior in the natural settings (Gorman and Clayton, 2005) where the data was being collected. A good example was where a traditional birth attendant responded that they stopped conducting deliveries, yet what was observed was strong evidence that she had just completed assisting a mother deliver a baby – this was later confirmed in the informal discussion with her.

Document analysis was also used. This formed a very useful part of the research, the history, procedures; roles of different stakeholders were understood by studying these documents. Documents analyzed include: Demographic and Health Survey Reports; Malawi Multiple Indicator Cluster Survey (MICS) Reports, Integrated Household Survey (HIS) Reports; Social Welfare Survey Reports; The Malawi EPI Policy Document; WHO Reports on Immunization; UNICEF Reports on Immunization; MoH Reports on Immunization, HMIS Reports, Sexual and Reproductive Health Policy, Malawi Growth Strategy Paper, HMIS bulletins, health facility registers and tally cards, TBAs ANC reports, births registers, village health registers and health passports for children whose data was collected, and other Research Papers on Immunization. Additionally, anecdotal evidence was collected from newspaper articles particularly during a Safe motherhood week and from radio and television programs in Malawi.

For this part of the study, a total of 88 interviews were conducted comprising of: 4 health personnel from a health facility, 6 HSAs, 7 TBAs, 70 mothers, and 1 chief. As Walsham (2006) noted, “continued involvement with the field situation, regardless of one’s starting position, can push the researcher towards a more involved stance” (p.322) from being an “outside researcher” to being an “involved researcher”. He describe how Walsham and Sahay (1999) faced a situation where they started off as relatively neutral and ended up being involved, offering direct advice and help to the field personnel. Their argument was that they felt it was appropriate and only fair to do so, as refusal would have been interpreted as lack of concern by the researchers. The experience which Walsham and Sahay (1999) shared in their paper is important to my research as I faced a similar situation where after two years of interacting with one community in one of the study sites, they felt at ease and would ask for advice, resources etc. They saw me as a link between them and the health sector.

Most of the analysis began during the data collection. This type of analysis was almost inevitable because, being in the field, collecting data, it was impossible not to start thinking about the data being collected, what was being observed and discussed. “… carrying out of fieldwork is the fundamental basis of any interpretive study” (Walsham, 2006:p.321). According to Walsham (2006), “all fieldwork is context-dependent and requires difficult choices to be made” (p.321). These choices do not only depend on the context; but also on preferences, opportunities and constraints (Walsham, 2006). All the data was handled by the researcher to ensure that the data is secure and confidentiality is guaranteed. Analytical memos were used to record the field observations and findings. The field notes were hand written, and in some cases graphics in the form of digital photos were taken.

In the process of collecting data, what was more important for this part of the study was to establish whether data generated from mothers who give birth outside health facilities finds its way into health facilities and how that is achieved. This revealed that it is more problematic to capture this data for two different reasons: (i) traditional births attendants stopped recording births in 2007 since the sexual and reproductive health and rights (SRHR) policy was effected, (ii) health surveillance assistants are not able to capture all the data generated within villages because they only visit the villages once a month.

4. ANALYSIS OF THE CASE STUDY

From the colonial days, chiefs (head of village) in Malawi were custodians of all data generated within their villages, including data of births and deaths. The chiefs were recording the data and sending it to district level for processing. Of the 70 mothers interviewed during the study, 50 were from an urban area, 20 from a rural area. Only 2% of the 50 mothers from an urban area utilised traditional births attendants. Of the 20 mothers from the rural area, 85% attended antenatal clinic at health facilities; however, only 10% had their babies delivered by professionally trained personnel. The rest delivered their babies at traditional births attendants and at home.

Although culturally each birth and death is reported to a chief, the culture of recording died over time in the post-colonial days. Each sector became responsible for capturing and recording their own data. Within the health sector, a health management information systems was implemented in 1999. Health surveillance assistants were now responsible for collecting health data generated in the villages. At policy level, health surveillance assistants are supposed to collect data from villages on a daily basis. Every month the health surveillance assistants are supposed to compile and report the data they collected to the supervisor at the associated health facility. The reality is different. Each health surveillance assistant is assigned more than 3 villages covering a population over 3000, and he or she has multiple roles. As such, they are only able to collect data from the villages which they serve at least once a month. Traditional births attendants were responsible for recording births and deaths occuring under their assistance. This data would then be collected from the traditional births attendants by the health surveillance assistants. In 2007, the Ministry of Health introduced the sexual and reproductive health and rights (SRHR) policy. This brought a twist in the way data was captured from the villages. The positive thing is, the health surveillance assistants are recognized and accepted within the willages which they serve and village members have trust in them.

4.1 A Twist in the Malawi Health Sector

The SRHR policy's goal was to reduce maternal and child mortality rates in line with the Millenium development Goals (MDGs), particularly MDG four and five – improving infant and maternal mortality respectively. Among other things SRHR policy redefined the role of the traditional births attendants from delivering babies to advising and motivating mothers to appreciate the need to go for skilled births attendants at health facilities. Earlier findings of the study (Kanjo and Kaasboll, 2009; Kanjo, 2011) established that the implementation of the SRHR policy led to health surveillance assistants losing their point of contact of collecting data in the villages. Prior to the policy shift, traditional births attendants used to keep records of the births which they assisted. Once SRHR policy was implemented, three different trajectories for the traditional births attendants emerged: (i) some stopped assisting in deliveries completely, (ii) some continued assisting deliveries discretely, but stopped recording the data, (iii) the last group continued assisting (emergencies only) but stopped recording the data. This lead to a situation where the data generated within communities would go unrecorded and the health surveillance assistants had no contact point for collecting the data.

4.2 Emergency of Community of Practice at Village Level

Prior to the policy implementation, traditional births attendants were operating independent of each other as competitors, and independent of other village members. Traditional birth attendants acquire their skills from their mothers over time, and through experience, they develop the skills further. However, after implementing the SRHR policy, a number of safe motherhood concerns emerged in the villages. Some pregnant women were unable to access health facilities due to transport problems, others due to their beliefs, whereas some would deliver on their way to health facility. After noting these challenges, in the rural study area, some members from neighbouring villages, championed by one traditional birth attendant, came up with the idea of a forming a village committee. The committee comprised traditional births attendants, chiefs, mothers from several neighbouring villages. The aim of the committee was to advise pregnant women, their spouses, and village members in general on the need to seek assistance from professional health personnel throughout pregnancy and during delivery. Pregnant women would be advised and followed up throughout their pregnancy to ensure that they are seeking professional assistance.

The village committee members had common concern although the group members were from diverse backgrounds. They were sharing their experiences, and coming up with their own indigenous solutions. Committee members meet every Monday afternoon to discuss and strategise on several issues of concern such as: which villages to visit, what advise to give, what to do with those that violate the safe motherhood advise etc. As they participate during meetings, members share ideas on how best keep track of pregnant women in their villages, how to assist emergency cases and so on. There was mention of “what advice we give to pregnant women in our villages” and “what we decided to do to a mother who does not deliver at a health facility”. Members devised their own local ways of punishing those who violate safe motherhood advice by making them pay *chindapusa* (penalty) in form of a chicken or goat or cash.

4.3 Knowledge Cultivation through Participation

Within the traditional health sector, participation is evident in the village committee as discussed above. Within the modern sector, we discuss participation at health facility level only. In the health facilities where the study was conducted, it was established that two groups meet to share their experiences, concerns and work out solutions. One group is that of all health professionals at the facility, including health surveillance assistants. Some of their concerns include: i) inaccurate health catchment population figures. These figures come from district and headquarter’s level to be used to calculate supplies for the facilities. *Health catchment area figures which we receive from district level fall short, as a result, we end up with shortage in supplies which we order* (Head of Facility). Health facility professions meet once every week to discuss issues of concern and work out solutions. For example, through their meetings, the facility health professionalssolved the problem of i) having a shortage of monthly supplies by using head counted figures instead of official estimated health catchment area figures. Head counted figures are collected door-to-door by health surveillance assistants from the villages which they serve. ii) Another challenge was that data generated within villages (from pregnant women who deliver their babies at home or at traditional births attendants). As a solution, the traditional births attendants were given mandate to be recording this data and health surveillance assistants were responsible for collecting this data from the traditional births attendants. However, when traditional births attendants stopped recording data due to the SRHR policy, the health professionals had to come up with other means of capturing data generated from the villages.

Another group which share common concerns through participation is that of health surveillance assistants. This group is for health surveillance assistants only. As they surveil villages in their catchment areas, they encounter different challenges which the share every fortnight. One such challenge is how each health surveillance assistant can surveil the villages allocated to them on a daily basis. As a solution, they designed monthly timetables to ensure that each village is surveilled at least once a month.

4.4 Transferring Knowledge and Data across Sectors

From the descriptions of the three groups above, the common denominator in terms of members of the group is the health surveillance assistants. Participation in all three groups enables the health surveillance assistants to be abreast with what is happening each groups. Prior to SRHR policy implementation. Health surveillance assistants would collect data recorded in notebooks by traditional births attendants. After the policy implementation, this source of data was not there and they would rely on what they are told by village members through conversations. However, the data from conversations was not reliable.

When a village committee was formed, the members of the committee encouraged each participating chief to keep records of the births and deaths reported. Other than just being informed, the chiefs, through their assistants record the data. This data was for their own use when evaluating how many pregnant women were advised within the participating villages.

5. DISCUSSION

The three groups identified in the case analysis that of: *village committee*, *health professionals*, and *health surveillance assistants* share a number of commonalities with the theoretical framework provided. Therefore the case analysis provides a persuasive argument that community of practices are evident within the health sector, both at community and health facility levels where data was collected. Specifically, the following characteristics of community of practice were identified: participation, diversity, knowledge generation, knowledge sharing through boundary connections. What matters most is not the existence of the communities of practice but the evidence of means of sharing the data from one community of practice to the other.

5.1 Community of Practices Identified

At community level, the *village committee* was identified as a community of practice. With lack of national policy for traditional health providers (WHO, 2008), the village members devised their own means of handling their safe motherhood concerns. Members from different villages with diverse backgrounds participate, generate knowledge and most importantly share same concerns and passion of safe motherhood through a village committee.

At health facility, two communities of practice were identified – one for all health personnel which we refer to as *health professionals* community of practice and the other for *health surveillance assistants* only. In each community of practice participating members were discussing issues of common concern, in the end they were generating knowledge utilised within the health sector.

5.1.1 Participation

Participation was very evident in the accounts given by members of the village committee members at community level and the health surveillance assistants in the way they conduct their business. All three groups - the village committee members, health professionals, and health surveillance assistants- meet consistently, on a weekly basis, specifically to share their concerns, views, and solutions on how to best handle the safe motherhood issues within their villages and catchment areas. The health surveillance assistants belong to all three groups; this allows for indigenous knowledge, ‘a key element of the social capital within the local communities which is mostly undermined and undervalued (Puri (2003) to be transferred and integrated into communities of practice that mostly utilise scientific knowledge. Hence, indigenous knowledge can find its way to international level and not be “seen as obstructing development” (Sillitoe, 1998). According to Wenger (1998), diverse and complex practices converge through mixtures of power and dependence; expertise and helplessness; success and failure through participation. In the village committee practices from traditional births attendants with diverse practices and expertise converge. At the same time, chiefs who have more power in the communities converge with other village members, sharing their experiences. Along the way, some success is achieved and on the other hand, failure is also registered. For example, from the case, there is success for antenatal visits, but when it comes to births, most pregnant women in rural communities still deliver at home or at traditional births attendants.

5.1.2 Diversity

Although their members share the same passion, the level of power and expertise differs between two communities of practice – *village committee* and *health professionals* . The *village committee* group comprise of chiefs (village head) with more power within their communities, traditional birth attendants who have more expertise in delivering babies, and other village members – some young, some old, some male, some female, some literate, some illiterate. Yet their concerns are common and they participate by the mutual engagement. They all meet and argue for safe motherhood. The *health professionals* group also comprises members with diverse expertise and qualifications. Yet their concern on maternal and child health data is to ensure that data generated within villages is captured into the health management information system.

5.1.3 Health Surveillance Assistants as Knowledge Brokers

The health surveillance assistants are members in all three communities of practice identified. Other than the *health surveillance assistants* community of practice, the second belong to the modern health sector, whilst the third community of practice belong to traditional health sector. This provides an opportunity for health surveillance assistants to act as brokers between the modern and traditional health sectors. Just like brokering help to spread and make sense of the knowledge in the contexts where it is used (Hearn and White, 2009), the health surveillance assistants are better placed to make sense of the transferred knowledge and data. Wenger et al., (2000) argue that not everything we know can be packaged as boundary objects, therefore the interactions of health surveillance assistants with the other two communities of practice assist to unpack the uncodified aspects of and indigenous knowledge. These interactions between modern and traditional health sector through the health surveillance assistants assist to bring together the indigenous and scientific knowledge and curbs the "tension between global and local caused by diversity in knowledge" (Randeira, 2007).

However, limitations exist in the way the health surveillance assistants interact with the village committee. Health surveillance assistant have multiple roles and this restricts their interaction with community level. Instead of surveilling villages on a daily basis, they surveil on a monthly basis. Where village committees exist, the members designed their own objects which they use by recording the data of pregnant women advised per village and date, pregnant women who do not go to health facility, and those who have not paid *chindapusa*. Much as this is for the benefit of their committee, the fact that health surveillance assistants form part of the committee as "peripheral" members makes them privy to village committee knowledge and data and transfer it into their own boundary objects.

6. CONCLUSION

Below we review whether the theoretical perspectives fit the case description and its analysis.

6.1 Identified Community of Practices

Three community of practices were identified. Two at health facility level – *health professionals* and *health surveillance assistants* community of practices, one from the community level – *village committee* community of practice. Participation, sharing common concerns, experience and knowledge were evident in all community of practices. *Health professionals* and *village committee* CoPs had diversity. Health professionals ranged from clinical officers, nurses, midwives, health surveillance assistants. Likewise, village committee had diverse in terms of composition; it included traditional births attendants, chiefs, health surveillance assistance, and other interested members of participating villages.

The participation in the three communities of practice provided opportunity for members to cultivate knowledge utilised to enhance safe motherhood both at community and health facility level. The *village committee* CoP specifically provided an opportunity of people at grassroot level to participate and contribute to how best to handle safe motherhood issues.

6.2 The Link Between Modern and Traditional Health Sector

Health surveillance assistants participate in all three communities of practice and they act as brokers of knowledge and data from the traditional health sector to modern health sector and vice versa.

We recommend that boundary crossing of knowledge and data between the two health sectors must be tailored from histrorical, cultural and modern perspectives. Historically, chiefs in Malawi were the custodians of data generated within their villages. Revisiting and putting mechanisms for recording this data by the chiefs or their assistants can give the health surveillance assistants a solid point of contact for collecting data generated from the traditional health sector.

6.3 Value of Strengthened Link through Community of Practice Lens

Other than managing knowledge resources, communities of practice theory can help organizations succeed in technological innovations and coping with globalization among other challenges (Wenger et al., 2000). Within the health sector, the communities of practice identified will enhance the innovations in the health management information system, particularly in improving data quality by including data from traditional practices, making Malawi health information system more comprehensive. The data quality will improve with the integration of indigenous and scientific knowledge as sharing of knowledge takes place across the communities of practice. As the knowledge and data is shared from one community of practice to the other, in the case of the health sector, it enables sharing from lower to highest level or local to global level.

We conclude that seeing data quality in terms of integrated data from both the modern and traditional health practices has far-reaching implications for our understanding of the process of collecting data into the health information systems. This involves utilisation of both indigenous and scientific knowledge, and building a strong link between the modern and traditional health sectors. The case suggest that it is possible to integrate data generated from traditional practices into HIS and improve the quality of data. The findings emphasize the benefits of 'hybridized knowledge that blends indigenous and scientific knowledge' (Puri and Sahay, 2003; Puri, 2007).

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Appendices

APPENDICES

Consent Form

My name is Chipo Kanjo. I am a Lecturer at Chancellor College and currently pursuing a PhD in Health Information Systems at the University of Oslo in Norway. Part of my PhD requirements is to conduct a research study in my home country in the area of Health and Information Systems. My research study is titled: An Analysis of Inter-Institutional influences on the Integration of Health Information Systems: *The Case of EPI Information Systems in Malawi*.

This research study aims to study the Malawi Expanded Program on Immunization and its information systems within the context of the health system and the overall Health Management Information System; identifying the context (and the roles) that influence the relationship between organisation coordination and integrated EPI information systems, the nature of these influences and the reasons for the quality of existing coordination. It will also explore how the EPI information systems (and other vertical programs) can be integrated within the overall HMIS.

I would therefore like to ask for your permission to observe your work and ask you some questions that may assist in finding answers to the problem.

All information observed and the responses from the questions will be treated in strict confidence. The interviews with different stakeholders may take 30 minutes to 1 hour.

The findings of this research will assist to improve the way new born babies' totals and immunization figures are collected by different health providers.

This study is funded by the department of Informatics, University of Oslo using funds for the GLOVAC project.

If you are willing to participate in this study, I will ask you to sign this consent form.

I have read the information provided above or the information have been read to me and have understood everything. I hereby accept to participate in this study and give full consent by signing this form.

Name: ____________________________________

Signed: ___________________________________ Date:_________________

Respondent/Participant

Signed: ____________________________________ Date:_________________

Principal Investigator (Edith Chipo Kanjo)

Chilolezo

Dzina langa ndi Chipo Kanjo. Ndine mphunzitsi pa wa za ma kompyuta pa sukulu yaukachenjede ya Chancellor College amene ndikuchita maphunziro a PhD ku sukulu ya ukachenjede ya Oslo ku Norway. Mbali imodzi yokwaniritsa zofunika pa maphunzirowa ndi kupanga kafukufuku. Ine kafukufuku wanga ndi wokhudzana ndi pulogalamu ya katemela.

Kafukufuku ameneyu ndi owunika za pulogalamu ya Katemela m'mene imayendela m'Malawi muno. Kweni kweni kafukufukuyu azakhala akuunika kuti kodi mabungwe amene amapanga za katemela, mgwirizano wawo ndi wotani? Nanga ana akabadwira ku malo kwawo kapena kutemeleledwa, chiwerengero cha ana omwe abadwa ndi kutemeleledwa chija amatani nacho? Kodi amachipeleka ku boma kudzela kwa DHO wa boma lawo kuti akaphatikizile limodzi ndi chiwerengelo chochokera ku mabungwe ena mu kompyuta?

Pa chifukwa ichi ndati ndipemphe chilolezo chanu ngati ndi ngakufunsenipo mafunso angapo kuti mundilongosolere mbali yanu momwe mumayendetsera zokhuzana ndi ana obwadwa kumene ndi omwe ali gulu loyenela kutemeleledwa. Zonse zomwe tikambilane zikhala zachinsinsi ndipo sizipelekedwa kapena kutchulidwa kwa munthu wina.

Zotsatila za kafukufuku ameneyu zizathandiza kusintha momwe chiwerengelo cha ana obadwa kumene ndi omwe atemeledwa chimatoleledwa ndikusungidwila.

Thandizo la kafukufuku ameneyu likuchokela ku dipatimenti ya za makompyuta ya sukulu yaukachenjede ya Oslo kudzera ku pulojekiti ya GLOVAC.

Ngati mwavomereza kutenga nawo mbali mu kafukufuku ameneyu, ndikupemphani kuti mutikitile chilolezochi.

Ndawerenga kapena andiwerengera tsatanetsatane wa zomwe kafukufukuyu akufunikira ndipo ndazimvetsa. Ndivomereza kutenga nawo mbali pa kafukufuku ameneyu.

Dzina: ____________________________________

Kutsindika: ___________________________________ Tsiku:_______________

Wotenga nawo mbali

Kutsindika: ___________________________________ Tsiku:_______________

Wofufuza (Edith Chipo Kanjo)

Interview Guide for TBAs

I am going to ask you questions about the clients whom you assist to deliver babies and what you do with the total number of babies delivered every month, and whether you refer your clients to have their babies vaccinated.

All the information given will be treated in strict confidence.

Place of Interview: _____________________________

Name of TBA: _____________________________

Age of TBA: _____________________________

Village & District: _____________________________

Date Interviewed: _____________________________

Education Level: _____________________________

Distance from Health Center: Private HC ________Government HC_______

1. Are you a trained or untrained TBA?

2. If trained, when were you trained?

3. Were you practicing before training?

4. When did you start practicing?

5. Roughly, how many clients do you have per month?

6. Do you advise you clients to have their babies vaccinated? (probe on: whether the clients are advised to go to health clinics fro check up after being seen by the TBA)

Interview Guide for Mothers who delivered at a TBA

I am going to ask you questions about where you had your baby delivered, the advice that you received concerning vaccination and your general impression with the services given.

All the information given will be treated in strict confidence.

Place of Interview: ______________________________

Name of Client: ______________________________

Age of Client: ______________________________

Village & District: ______________________________

Date Interviewed: ______________________________

Education Level: ______________________________

Distance from Health Center: Private HC ________Government HC_______

1. How many babies did you have delivered at a TBA?

2. Why did you choose to have you baby delivered at a TBA?

3. Were you given any advice about vaccination by the TBA?

4. What was your general impression with the services that you received at the TBA?

Interview Guide for Statistians/DHO at the DHOs Office

I am going to ask you questions on how the figures of the total number of babies delivered and vaccinated every month are collected and processed by your office.

All the information given will be treated in strict confidence.

Place of Interview: ______________________________

Name of Statistician: ______________________________

Village & District: ______________________________

Date Interviewed: ______________________________

1. Is *every* birth registered now? (probe for evidence).

2. List the health providers that give immunisation figures to your office (check the frequency which figures are given; check health providers that give figures against those available in the district).

3. Get vaccination figures. (these figures will be compared with estimates of children in chosen research sites).

4. How often do you submit figures to the Ministry Headquarters?

5. Who enforces health providers to be submitting figures to the DHO? (check what measures are put into place)

UNIVERSITY OF MALAŴI

Principal

Prof. R.L. Broadhead, MBBS, FRCP, FRCPCH, DCH

College of Medicine
Private Bag 360
Chichiri
Blantyre 3
Malawi
Telephone: 677 245
677 291
Fax: 674 700
Telex: 43744

Our Ref.:

Your Ref.: P.07/08/687

27 March 2009

Chipo Kanjo
Mathematical Sciences Department
Chancellor College
P.O. Box 280
Zomba

Dear Ms Kanjo,

RE: P.07/08/687 – An analysis of Inter-Institutional influences on the Integration of Health Information Systems: The Case of EPI Information Systems in Malawi

I write to inform you that COMREC reviewed your proposal mentioned above which you resubmitted. I am pleased to inform you that your proposal was approved after considering that you addressed all the queries which were raised in an earlier review.

As you proceed with the implementation of your study we would like you to take note that all requirements by the college are followed as indicated on the attached page.

Sincerely,

UNIVERSITY OF MALAWI
COLLEGE OF MEDICINE
27 MAR 2009
COMREC
P/BAG 360, CHICHIRI, BLANTYRE 3

Dr. S. Kamiza
VICE CHAIRMAN - COMREC

SK/ck

Telephone: + 265 01 524 588
Facsimile: + 265 01 524 320

All Communications should be addressed to:
The District Health Officer

MINISTRY OF HEALTH AND POPULATION,
ZOMBA DISTRICT HEALTH OFFICE,
PRIVATE BAG 18,
ZOMBA, MALAWI

11th November, 2008

To Whom It May Concern

Re: Authorization to Conduct Research in Zomba District

I write to inform you that the bearer of this letter, Mrs. Edith Chipo Kanjo has been given a go ahead to conduct research in two catchment areas in Zomba district. The research study is titled: Analysis of Inter-Institutional Influences on the Integration of Health Information systems: the case of EPI Information Systems in Malawi.

The researcher aims to establish how data of new born babies and vaccinations is collected and reported from source, and explore how EPI information from different vertical programs and players is integrated within the overall Health Management Information System.

The Zomba DHO office has given permission for the research to be conducted within the district with the hope that the findings from the research will be shared with our office. The research will be conducted within the year 2009.

DISTRICT HEALTH OFFICER
11 NOV 2008
PRIVATE BAG 18, ZOMBA

Sincerely,

Dr. F.K. Ludzu

DISTRICT HEALTH OFFICER