

Harnessing community knowledge for health:-Case studies from community health service and information systems in Ethiopia.

By

Zufan Abera Damtew



**Dissertation Submitted in partial fulfillment of the requirements of the
degree of Doctor of Philosophy (PhD)**

Faculty of Mathematics and Natural Sciences

Department of Informatics

University of Oslo

Oslo, Norway

June, 2013

Dedication

To the memory of my father Abera Damtew, who allowed me to perceive the value of education.

And

To Babaye, Nati, Piam, Sami and Lulusha for their love, support and encouragement

Acknowledgement

There are many people whose support, encouragement and contribution led to the successful completion of this thesis. Specifically, I would like to thank and express my heartfelt gratitude to the following people, who deserve special recognition.

First and foremost, I would like to thank my first supervisor, Prof. Jens Kaasbøll for his unconditional support, intellectual guidance, prompt responses, directions and insights that provided me with an excellent academic foundation to move forward. I am also indebted to my second supervisor Prof. Margunn Aanestad for providing thoughtful critiques and comments throughout my research study. I am extremely fortunate and proud to have both supervisors whose offices were open at any time when I wanted assistance. Thank you Jens and Margunn, you are very supportive.

My sincere thanks go to my former supervisor, Prof. Jorn Braa, for his motivation and allowed me to be part of the informatics team. I appreciate his assistance.

I am very thankful to Dr Shegaw Anagaw Mengistie for his intellectual and unreserved support throughout my study. I have received insightful comments from him that contributed towards the quality of this thesis. Asst. Prof. Petter Nielsen and Dr Miria Grisot deserve special thanks for providing thoughtful critiques and detailed comments on the draft versions of my thesis. The discussions I have had with you helped to expand the theoretical insights used in my study. I am also grateful for the following Faculty members, Dr Bjørn Erik, Prof. Eric Monteiro, Prof. Kristin Braa, Prof. Sundeep Sahay and Dr Bendik Bygstad for their input to my study.

I am grateful for the Norwegian State Education fund, Lånekassen and Globvac project for providing financial support for this study. I also extend my gratitude to the administrative staff at international student office, especially for Michele and Lynn, and administration staff at IFI especially, Lena Korsnes, Mozhdeh Harat and Anne Cathrine.

It would have been impossible to conduct this research without the cooperation of study participants. I would like to thank all the respondents, especially for health managers, health workers and the administrative staff at Amhara region health sector and TVETIs, Ethiopia for their great cooperation.

There are many colleagues who have been supportive in many aspects, sharing literatures and participating in writing seminars, special mention; Chipso, Yahya, Louisa, Desalegn, Nigussie, Zegaye, Elise, Chris, Petter Øglund, Hanne Cecilie, Zeferino, Edem, Ime and many others.

My Ethiopian friends in Oslo offered me unforgettable social life and support throughout my stay in Norway. I enjoyed the company of Emebet, Simri, Engdu and Solomon, Hirutie and Tekilu, Sofi and Shegaw, Birk and Birie, Elsy and Abyot, Bizuye and Meseret, Betty and Zeg, Amele and Mulugeta, Alem and Beyene, Seble and Anagaw, Beliyu and Yared, Tg, Girum, Zewge, and Sol. My stay in Norway was fruitful because of you. I really appreciate your friendship and I am very grateful to you. Sweet boys Nati and Yimreha, you are special for me and my kids. Thank you Blen and Endalik, and Ashebir for hosting Nati during my absence.

I owe a lot to my family; my sisters, brothers and in-laws for their encouragement and confidence in me, they always encourage me to see the bigger picture and fulfill my intellectual curiosity. I appreciate your enormous inspiration that heartened me to achieve more. I am also thankful to all my friends from Ethiopia, especially to S/r Mulu Hailu, Bizualem Mekonnen and Tigist Nigatu for their goodwill and their support to my family while I was abroad. Many thanks to Yalgie, Messi and Birkety for much enjoyed stays in Addis.

Last, but not least, my deepest appreciation goes to my beloved husband, Amsalu Shiferaw, for his love, all rounded support, encouragement and patience. This dissertation would have been impossible without you. You are always my motivation to move my career forward. My kids Lulusha, Sami, Piam and Nati, I owe you special thanks for love, encouragement and comprehension of the mother being away from home. I love you my wonderful children.

To my Lord, for health and opportunities

Table of Contents

Chapter One: Introduction.....	1
1.1 Significance of the Study.....	1
1.2 Research Motivation.....	2
1.3 Theoretical Approach.....	5
1.3.1 Perspectives of Knowledge and Knowledge Communication.....	5
1.3.2 The Issue of Standards within the Domain of Health Care and HIS.....	8
1.4 Research Approach.....	9
1.5 Research Aim and Questions.....	10
1.6 Research contributions.....	10
1.7 Organization of the Thesis.....	11
Chapter Two: The research setting: The Context of Ethiopia.....	12
2.1 Geography and Demography.....	12
2.2 Socio-Economic and Education Profile.....	14
2.3 Health Sector and Health Problems.....	15
2.4 Health extension program.....	19
2.4.1 Expansion of Primary Health Services.....	19
2.4.2 Health Extension Program implementation in Amhara Region.....	23
2.5 HIS Reform in Ethiopia.....	24
Chapter Three: Literature Review and Theoretical framework.....	28
3.1 Health information systems and community knowledge.....	28
3.1.1 Community information systems.....	28
3.1.2 The Community Knowledge: Characteristics and Generation.....	30
3.1.3 Utility of the Community Knowledge.....	32
3.2 Theoretical Framework.....	35
3.2.1 Perspectives on Knowledge Sharing.....	35
3.2.2 Communicating Knowledge across Boundaries.....	37
3.2.3 Knowledge broker.....	42
3.2.4 Combining scientific and community knowledge.....	44
3.2.5 Standardization and Flexibility.....	47
3.3 Summary-Analytical Framework of the Study.....	52
Chapter Four: Research Methodology.....	54
4.1 Origin of the Research.....	54
4.2 Research Approach and Design.....	55

4.3	Study area	57
4.4	Data Collection Techniques	60
4.5	Data Analysis.....	66
4.6	Ethical Considerations.....	70
4.7	Personal Reflections.....	70
4.8	Summary of the Methods Section	71
Chapter Five: Findings.....		73
5.1	Summary of papers	73
5.1.1	Paper 1: Using and Sharing Locally Generated Information for action: The Case from Three Developing Countries	73
5.1.2	Paper 2: Target Setting Procedures for Immunization Services in Ethiopia: Discrepancies between Plans and Reality.....	75
5.1.3	Paper 3: Revisiting the Quality of Health Extension Workers’ Training: Case- study from Amhara Region, Ethiopia.....	77
5.1.4	Paper 4: Benefits of Local Knowledge in Shaping standards:-A Case Study from Community Health Service and Information Systems in Ethiopia.	78
5.1.5	Paper 5: Accelerating Health Service and Data Capturing through Community Health Workers in Rural Ethiopia: -A Pre-requisite to Progress.....	81
5.2	Understanding the role of community knowledge in the health service provision and HIS implementation of a Developing Country:-Linkage between papers.....	87
5.3	HEWs and Community Volunteers as Knowledge Brokers	90
Chapter Six: Contributions and Conclusion		95
6.1	How the research questions were addressed?.....	95
6.2	Theoretical contributions.....	104
6.2.1	Utilization of the community knowledge in shaping standards	104
6.2.2	The role of knowledge brokers in communicating knowledge across boundaries. ...	106
6.2.3	Establishing knowledge alliances between the sources of knowledge from the community and scientific bases.....	108
6.3	Practical Contributions and Recommendations	109
6.3.1	Studying the current practice and propose strategies for effective knowledge sharing and multiplication of beneficial practices.....	109
6.3.2	Proposing mechanisms to deal with the practical challenges related to the health service planning in developing countries.....	112
6.4	Concluding Remarks.....	114
References		115

List of Figures

Figure 2.1: Map of Ethiopia and its Regions zoomed in from African Continent	12
Figure 2.2: Ethiopian Health tier system; source, FMOH, 2010: 78.....	16
Figure 2.3: Components of the health extension program, adapted from FMOH, 2007	20
Figure 2.4: Hand drawn map and health indicators of Arsa Gibha rural Kebele	21
Figure 2.5: The family graduation ceremony at Bacha kebele, Dangla district	24
Figure 3.1: 3-T Framework and the Four Characteristics of a Pragmatic Boundary Process, adapted from Carlile (2004: 563)	41
Figure 3.2: Illustration of the knowledge brokering role of HEWs and community volunteers within the community and scientific knowledge domains.	52
Figure 4.1: Map of the Amhara region.....	58
Figure 4.2: Public health actors included in this study	59
Figure 4.3: Photos taken during Field visits	65
Figure 5.1: Linkage between papers appended in this thesis.....	90
Figure 5.2: Interactions between a HEW and a household, and among neighbors in a rural village...	93
Figure 6.1: Examples of fixed and flexible standards and alternative practices by health workers.....	97
Figure 6.2: Three levels for managing knowledge across boundaries of the increasing complexity (Adapted from Carlile, 2004: 558)	107

List of Tables

Table 2-1: Mortality rates at different age groups and maternal mortality ratio in Ethiopia, Source Central Statistical Agency, 2012.....	17
Table 3-1: Description of three properties of knowledge boundaries, according to Carlile (2004:238)	37
Table 4-1: Distinction between Positivist and interpretive approaches.....	56
Table 4-2: Respondents work place, job responsibility and number of interviews.....	63
Table 5-1: Synthesis of Research findings.....	84

Acronyms

- EDHS.... Ethiopian Demographic and Health Survey
- EOS.... Enhanced Outreach Strategy
- EPI... Expanded Program on Immunization
- FMOH.... Federal Ministry of Health of Ethiopia
- GIS.....Geographic Information Systems
- HEWs.... Health Extension Workers
- HEP....Health Extension Program
- HIS.... Health Information Systems
- HIV/AIDS..... Human Immuno Deficiency Virus/ Acquired Immuno Deficiency Syndrome
- HSDP.... Health Sector Development Plan
- ICD.... International Classification of Diseases
- ICSU.... International Council for Science
- IT.... Information Technology
- MDG.... Millennium Development Goals
- MCH.... Maternal and Child Health
- PHC.... Primary Health Care
- RHB.....Regional Health Bureau
- TB.... Tuberculosis
- TBA.... Traditional Birth Attendants
- TVETI.... Technical and Vocational Education Training Institution
- vCHWs.... Voluntary Community Health Workers
- WHO....World Health Organization

Abstract

The community based health service is escalating in many developing countries as a means to fulfill the health related millennium development goals. Besides to providing primary health care, these community health workers collect, compile, transfer and use community health data. The potential benefits and opportunities of assignment of these community health workers in low-income countries have brought not only remarkable improvement on access to and coverage of communities with basic health services, but also helps to increase the community participation for their own health activities. Recently, the search for sustainable solutions to the development problems that continue to confront developing countries has led to renewed interest in the potential contribution of the community knowledge. The importance of community knowledge is acknowledged to enhance sustainable development endeavors and acceptance of the scientific methods by the community. Thus, the two knowledge systems from scientific and community sources need to be bridged. In line with this pressing need, this thesis aims to develop an understanding of the role of community knowledge in the public health sector of a developing country. The particular focus is the health service provision and information systems at the community level, which was explored by analyzing the day-to-day practices of community health workers, known as health extension workers who serve the rural residents in Ethiopia. An interpretive approach using qualitative methods was adopted in the study and empirical data were collected through interviews, participant observation, as well as, detailed review of formal reports, documents and publications. The study was conducted in Ethiopia and took place between 2008 and 2012. Theoretically, this thesis drew on concepts from the knowledge domain, which includes the knowledge bases from the community and scientific sources, and knowledge boundary and communication. The study take practice based perspective that used to understand the day-to-day practices of community health workers, and the impact of community knowledge in the health sector. The concept of standardization and flexibility were also used to emphasis the role of community knowledge to implement the standards at the ground.

The findings show that health extension workers work in collaboration with other public health actors that include community volunteers, households, colleagues and their supervisors. They mostly knew their population and the context since they interact and observe the practices within their communities and build on the knowledge for that community. This context-specific knowledge is commonly informing their practices. This thesis showed the quandary arises from the mismatch between population data known by the community health workers and projected from census using scientific methods. However, rather than the conflict between the sources of knowledge, the overall findings suggest that relevant practices originated from the community knowledge need to be integrated with the scientific sources and it has presented how community knowledge compliments the knowledge sources from scientific bases. This research also showed the knowledge boundaries and communication patterns in the health extension workers training schools and public health sector of Ethiopia. Health extension workers and volunteers were taken as knowledge brokers who facilitate knowledge communication between the new health initiatives and rural households. It has also identified the potentialities that facilitate or inhibit knowledge communication among the public health actors. To enhance knowledge communication across boundaries, this thesis suggests the need to nurture the existing potentials and mitigate constraints.

This thesis makes contribution both for the domain of public health and information systems. The theoretical contributions include building a framework that categorizes the fixed and flexible elements within a standard, which provided a unique insight to deal with flexible standards based on the community knowledge. It has also showed illustrations for integrating knowledge from the community and scientific sources. Identifying the role of knowledge brokers in communicating knowledge across boundaries in the public health sector of a developing country is also another contribution. The practical contributions concerns on studying the potential for improving the community health service and health information systems by considering the local input from the health extension workers, community volunteers and the community; consider the population data both from the scientific and community sources, equip health extension workers training schools with relevant teaching materials, make available unified data collection and reporting tools, and offer continual refresher trainings for community volunteers.

Chapter One: Introduction

This chapter introduces the research that is the basis of this thesis. The chapter is organized into six main sections. First, the background of the study is presented focusing on the significance of the study and research motivation. Hereafter, an overview of the theoretical basis will be presented in section three followed by the research approach in section four. Section five discusses the research objective and research questions. Section six gives an outline of the contributions. Finally, the chapter closes by providing the organization of the thesis.

1.1 Significance of the Study

This study examined how community knowledge is used in the health care sector of a developing country. Community knowledge in this thesis is applied to denote knowledge of the community of a particular rural area. This includes their interactions and experience within that area, their traditions, and incorporation of knowledge emanating from elsewhere into their everyday activities. The indigenous peoples of the world possess an immense knowledge of their environments, based on centuries of living close to nature (Fernandez, 1994; ICSU, 2000; Ma Rhea, 2004). Puri (2003, 2007) reveals that indigenous knowledge of the environment can provide context-specific understandings that can complement scientific knowledge. Development initiatives need to draw on the rich body of knowledge that community members have acquired to support their activities.

In the context of health sector reforms, many countries have implemented community based health services in order to achieve the ideals of primary health care (PHC) to the needy (WHO, 2002). Considering the initiation of these community health programs in many developing countries, there is a need to explore how the community knowledge can be effectively used for supporting implementation of health service provision and health information systems (HIS), which is the theme of this study. There are at least three empirical reasons for selection the theme of this study. First, although literature has indicated that community based health services are successful (Banteyerga et al, 2011; Otieno, 2012), there are some issues related to the use of context-specific knowledge of the community and local work practices (Kanjo, 2012; Piotti et al., 2006). Second, the community based health service entails the need to collaborate among the health sector staff and the community with different types of knowledge that require knowledge communication across boundaries (Carlile 2002, 2004).

This demands analyzing the different knowledge boundaries and the means that may facilitate knowledge communication. Third, community health services focus on disease prevention lessons and high-impact basic services at low cost (Berman, Gwatkin and Burger, 1987). However, curative service is common ones given at the health facilities and this shift sometimes dismays the clients and creates a gap (Banteyerga et al., 2011). Hence, unless these gaps and underlying problems are understood and dealt with, many breakthroughs in community health programs fail (WHO, 2007).

According (WHO, 2007: p 3), the umbrella term “community health worker” embraces a variety of community health aides selected, trained and working in the communities from which they come. The roles and activities of community health workers are enormously diverse over time, within and across countries and across programs. While in some cases community health worker perform a wide range of different tasks that can be preventive, curative and/or developmental, in other cases they may be appointed for very specific interventions. Besides, by capturing the complex and dynamic epidemiological and community shifts at the household level, community health workers can provide vital information to inform the national health system priorities (Otieno, 2012). Community health workers had and have a large number of different titles (WHO, 2008). Some are volunteers supported in kind by the community, and some are paid through community or government funds. The focuses of this study are community health workers who serve the rural dwellers in Ethiopia; the health extension workers (hereafter HEWs) and community volunteers. Health extensions workers are salaried government employs who have completed grade 10 formal education and trained for a year in public health activities, whereas community volunteers are members of a given community who volunteer to support HEWs.

1.2 Research Motivation

In recent times, community health workers are best positioned to deliver health services at grass-root level as countries around the globe strive towards meeting the Millennium Development Goals (MDGs) (WHO and Global Health Workforce Alliance, 2010). It is recognized that better health makes an important contribution towards economic progress, as healthy people live longer, are more productive, and save more (OECD, 2003). Thus, health is high on the international agenda and improving the health of poor people is a central issue in development. The MDGs are the most successful global anti-poverty push in history (United Nations, 2011). Three out of eight MDGs: Reduce child mortality, Improve maternal health and Combat HIV/AIDS, malaria and tuberculosis, are directly related to health. The MDGs

are inter-dependent; all the MDG influence health, and health influences all the MDGs. Ethiopia is one of the countries agreed to fulfill the MDGs by the year 2015. Accordingly, accelerated expansion of the PHC coverage strategy through the health extension program has already been developed and endorsed by the government of Ethiopia with a view to achieving universal coverage of the PHC (FMOH, 2005).

The health extension program is the way of extending basic health care from institutional based to community and household level that creates opportunities to every household to access basic health services. The program is implemented by deploying two salaried female HEWs, at each village (Kebele). The HEWs were likely to be most effective when working in cooperation with other public health actors that include community volunteers, traditional birth attendants (TBAs), households, colleagues, their supervisors and other partners. This partnership has been found to be basic for promoting preventive health practices and improving health outcomes (Banteyerga and Kidanu, 2008). The health extension program also requires active participation of the community. Thus, every family can improve their health status through their active participation and their own actions and efforts (FMOH, 2005).

With about 85 percent of the population living in rural areas, the health extension program brings health services closer to the population at the family level (Banteyerga and Kidanu, 2008). HEWs also collect, analyze, transfer and use community health data (Damtew, 2010). Otieno (2012) also revealed that deploying of the community health workers, who provide health services to the community and household level as well as to gather data, constitutes a promising improvement both for the HIS and health care provision. Hence, there is a promised potential towards the improvement of PHC delivery and community HIS in Ethiopia because of the implementation of this community based health initiative (FMOH, 2007). The health extension program is also receiving international attention as it appears to be successfully contributing to dramatic improvements in key health indicators in Ethiopia that are essential to fulfill the MDGs (USAID, 2013). In Ethiopia, over 85% of the population has now access to PHC: the figure has increased particularly rapidly in the past few years following the introduction of community based health service through the health extension program (Banteyerga et al, 2011).

Improved data and monitoring tools are crucial for devising appropriate policies and interventions needed to achieve the MDGs. Although some progress is being made, reliable statistics for monitoring development remain inadequate in many poor countries. The

challenge of building in-country capacity to produce better policy-relevant data is enormous (United Nations, 2011). As a result of recent efforts, more data are now available in the international series for the assessment of trends. Within developing countries, the rural-urban dichotomy has disparities geographically, demographically, economically, and environmentally (Kanjo and Kaasbøll, 2011). Most areas are rural, the rural population is higher than urban, and most of the poor reside in rural settings wherein there is poor infrastructure. Within this context, community health workers serve the rural population and generate health data in rural villages. They mostly cooperate with community volunteers, for instance, community health workers in Malawi have been using TBAs as their source of data on births and deaths generated within communities (ibid). Besides, these community health workers live in villages among the community, hence, they are able to develop context-specific knowledge of the community as they interact with the same group frequently.

Context-specific knowledge of the community health workers enable them to identify people within their community whom they can trust and use those people as point of data collection (Damtew, 2010; Kanjo and Kaasbøll, 2011). Brehon (2000) emphasizes that the starting point for any venture in a community context is the current practice of that community. The author has argued that if one looks at the community's practice, beliefs, and knowledge, one has a firmer foundation on which to build a task. The indigenous community knowledge has been the basis for agriculture, food preparation and conservation, health care, education, and the wide range of other activities that historically sustains a society and its environment in many parts of a world for many centuries (Senanayake, 2006). Conversely, many scientists and academics have considered indigenous knowledge systems as primitive, simple and static (Warren, 1989, Hoben, 1995). Kanjo (2012) argue that local community knowledge in the health sector was undermined, since the system favors the modern health sector. Other researchers, on the other hand, have stressed the need for acknowledging the importance of community knowledge base for sustainable environmental development and acceptance of the scientific methods by the community (Rahman, 2000; Rengalakshmi, 2006; Puri, 2007). The authors mentioned that the dichotomy between indigenous community knowledge and modern scientific knowledge is increasingly seen as a cause for underdevelopment. The community knowledge is not the panacea for solving all problems related to development (Kapoor, 2002), but can complement the scientific knowledge in order to benefit from the different strengths of the two systems. Hence, the two knowledge domains from scientific and community sources need to be bridged (Rengalakshmi, 2006; Puri, 2003, 2007). Many of the

solutions to public health problems exist but are not applied because of knowledge gaps among and within countries. These gaps can be bridged through the development of an environment that encourages the creation, sharing and effective application of knowledge to improve health of the community (WHO, 2006).

Recognizing the need for fostering community health services and information systems for the betterment of public health in developing countries coupled with my own background and work experience have provided the basic motivation for conducting this study. The health extension program launched in 2003 by the Ethiopian Federal Ministry of Health (FMOH) is an innovative community based program. Such types of initiatives, I argue, need to be considered in the literature to benefit from the existing potentials and to mitigate the constraints encountered. My background is from the health sciences and information sciences. I have a long experience with working at different levels and positions in the health care system of Ethiopia, in Amhara region. Accordingly, I have been involved in various activities related to the health extension program and have had the chance to explore the problems associated with the health extension program and HIS in my daily work. I have also been involved in the training of master students, both health workers and from information science, in Ethiopia and Norway on the role and use of HIS to support and thereby improve health service management. These exposures helped me to see the drawbacks and the improper functioning of the HIS, something which inspired me to develop a deeper understanding of the phenomena.

There is a need to strengthen the HIS starting from the community level; from where the health data are mainly collected, especially in rural settings where majority of the population reside. These multiple perceptions initiated me to be more interested in the study area. Therefore, this thesis rests on community based health services and information systems.

1.3 Theoretical Approach

1.3.1 Perspectives of Knowledge and Knowledge Communication

The search for sustainable solutions to development problems that continue to confront developing countries has led to renewed interest in the potential contribution of the indigenous community knowledge (Dube and Musi, 2002). This has been defined as a systematic body of knowledge acquired by local people through accumulation of experiences, informal experiments and intimate understanding of the environment in a given culture (Rajasakeran, et al., 1992). Mwadime (1999) has stated that this knowledge domain

“embraces knowledge of tools and techniques for assessment, acquisition, transformation, and utilization of resources in their locality” (p. 247). This thesis used the terms indigenous knowledge or community knowledge to denote knowledge of the community of a particular rural area in general. Specifically this concerns context-specific knowledge of HEWs and community volunteers in particular, when they use it in the processes of health service provision and data management.

It is very clear that there is much to be learned from indigenous knowledge systems of local people. Academics, policy makers, planners need to pay greater attention to this invaluable treasure of knowledge (Senanayake, 2006). This study also seeks to understand how context-specific knowledge of the community is utilized and shared in the public health sector of a developing country, which in turn may impact health service provision and HIS. There have been numerous debates amongst researchers about knowledge creation and sharing. For instance, Grover and Davenport (2001) mention sharing of knowledge occurs at various organizational levels and between organizations. At these levels, knowledge sharing occurs between individuals, from individuals to groups, from individual to explicit sources, between and across groups, and from groups to the organization (Alavi and Leidner, 2001). However, since knowledge is sticky to its context and implicit, sharing of knowledge becomes a difficult phenomenon (Polanyi, 1996; Zach, 1999). It indicated that this knowledge domain cannot be easily articulated or communicated in codified forms. Knowledge of this kind is experience-based; it can only be revealed through practice in a particular context and transmitted through networks of human relations (Rajasakeran et al., 1992). As Cook and Brown (1999) and Carlile (2002) stressed, knowledge and knowing cannot be separated from an individual's engagement in the 'practicing' of their practice.

Wenger (2000) has stated that shared practice by its very nature creates boundaries, which offer difficulties and possibilities through connecting communities. Carlile (2002, 2004) has also mentioned that there are three progressively complex knowledge boundaries that require different communication processes. According to the author, communication among people requires common knowledge of the syntax (structure), semantics (meaning), and pragmatics (practical) of language in order to understand each other's domain specific knowledge. An increase in the difference, dependence and novelty of domain-specific knowledge between people creates progressively complex boundaries of conveying knowledge. The more are the complex boundaries, in turn; require three progressively more complex processes of knowledge transfer, translation and transformation. In short, it is designated as the 3-T

framework. The knowledge boundary and knowledge communication concepts, as described by Carlile, are relevant for this study. Because the notion of knowledge boundary and communication allows explaining the process of communicating across knowledge boundaries amongst communities that may consist of people in different specialized domains (Van de Ven, 2007). This thesis is also concerned with how knowledge might be communicated and used in the public health sector among people that have different domain specific knowledge.

This thesis also explores the knowledge brokering role of HEWs and community volunteers in communicating new health initiatives across knowledge boundaries with rural households. The role of knowledge brokers as an intermediary is widely documented (Hargadon and Sutton, 1997; Pawlowski and Robey, 2004; Lomas, 2007; Rolls et al., 2008). The primary task of a knowledge broker is connecting knowledge seekers to sources of knowledge in a particular topic area (Dougherty, 1992).

In this thesis, I will interchangeably use the term knowledge sharing and knowledge communication. The first represents the most common way to articulate conveying of the expected knowledge and skills, and the latter is adopted from Carlile (2002, 2004); to indicate knowledge transfer, translation and transformation across the knowledge boundaries. Knowledge sharing (communication) is of interest for this thesis since it deals with the community level health service provision and HIS that require close interaction and knowledge sharing amongst public health actors. Knowledge communication mechanisms in this case can refer to the way by which the HEWs share knowledge with other public health actors, including community volunteers, rural households, peers, their teachers and supervisors.

By drawing upon the 3-T framework formulated by Carlile (2002, 2004), this thesis emphasizes the important role that health managers and other stakeholders need to play in creating conditions and incentives that may facilitate knowledge communication amongst public health actors. Eventually, the Carlile 3-T framework can provide an understanding of the approaches to communicating knowledge across boundaries for building partnerships. It also helps to develop the notion of knowledge communication across boundaries in the public health sector and how it can be applied in everyday practices of community health workers in a developing country.

Studying the community health programs enables me to contribute to practice based studies (Carlile 2002, 2004; Puri, 2007; Kanjo, 2012). In line to practice-based studies, I have viewed

learning as being a situated and an integral part of practices and relationships. This body of literature has demonstrated the usefulness of viewing knowledge as a process rather than something cognitive taking place in the heads of individuals or as context-free commodities (Gherardi, 2000). I have studied the everyday practices of HEWs and community volunteers, hence practice-based theories would be appropriate to deal with knowledge and its communication across boundaries in the public health sector.

1.3.2 The Issue of Standards within the Domain of Health Care and HIS

Standards are required to produce and maintain similar work practices in different places or countries (DeVries, 2006). Some standards are general purpose, while others are sector specific (for instance, health care). In the health care sector, Timmermans and Berg (2003) have identified various kinds of standards categorized as design, terminology, performance and procedural standards. Design standards set structural specifications, such as the size of the buildings; terminological standards creates stability of meanings such as the International Classification of Diseases (ICD) code for specifying how various diseases are registered and compared across contexts; performance standards set out specifications such as level of complication rates for specific observation, and procedural standards specify the process, such as the working guidelines. Procedural standards are most relevant for this study. Specifically, this thesis has conceptualized the standardized working guidelines as procedural standards that guide health workers to carry out activities related to the HIS and health service provision. As such, standardizing in HIS refers to the process of employing best practice principles and guidelines for the collection and storage of health care data in a uniform manner across various facilities, levels, and programs. This includes the use of uniform instruments and practices for collection of data, its analysis and transmission (Mavimbe, 2007). Different researchers have demonstrated that information systems need to be situated to the local context of use. Since conditions and needs are not similar in different contexts, there is a need to balance the local and global demands which means that the standard must be flexible enough to be appropriated to varieties of work practices and locations (Bowker and Star, 1999; Braa and Hedberg, 2002; Hanseth et al, 2006). For example, Braa and Hedberg (2002) have explained the different informational needs of the health hierarchies in South Africa. As a result, they introduced a modular approach of standardizing, called as the ‘hierarchy of standards’ which helped them to work towards building a consensus amongst various actors during the standardizing process. They propose the principle of a hierarchy of standards

where the lower levels are indicated to have the right to define their own data set as long as they include the data set of the higher level.

Researchers have also described how protocols or guidelines as standards stipulate an explicit order that may be difficult to implement in an actual context. For example, Timmermans and Berg (1997) analyzed clinical protocols as standards for a set of practices, actors and situations, and prescribed a set of interventions that should be performed in a similar way, to achieve results which are comparable over time and space. However, the authors emphasize that “patients and medical personnel are not turned into mindless followers of medical scripts” (1997, p.288), but protocols are re-appropriated to make them “do-able” for the participants within their context. Similarly, Mavimbe (2007) also mentioned that standardized guidelines are essential for the Expanded Program of Immunization (EPI) to work, but are neither a guarantee nor an absolute measure that will be used uniformly within the context and across the health care hierarchies.

This thesis analyses how community knowledge helps to implement the standardized working guidelines that guide health workers with the available materials in rural villages of Ethiopia. This research compliments the flexible standards literature that has emphasized the need of standardized working guidelines or protocols with the required flexibility (such as Komaroff 1982; Wennberg 1991; Timmermans and Berg, 1997 and Mavimbe, 2007).

1.4 Research Approach

This is a case study with qualitative methods and an interpretive research paradigm, which encourages researchers to make sense of the phenomenon being studied through the analysis of subjective interpretations of those involved (Walsham, 1993, 1995). The interpretive research approach emphasizes the role of action and the agent, and the dynamics by which they mutually constitute and are constituted (ibid). This research seeks to understand how community knowledge is used and communicated among different public health actors in the process of health service provision, and collection, transmission, and use of health data. Therefore, the interpretive approach is an appropriate strategy to develop a situated understanding of the context which is difficult to understand through quantitative approaches (Silver, 2005). Case-study analysis is commonly used to explore and understand complex and localized issues and social environments (Yin, 1994). As the qualitative research takes place in a natural setting: the qualitative researcher often goes to the site (home, office) of the participant to conduct the research. This enables the researcher to develop a description at a

level of detail about the individual or place and to be highly involved in actual experiences of the participants (Creswell, 2003).

Specifically, for the purpose of this study, I selected six health districts, in three zones of Amhara region, Ethiopia. Amhara region is known by its efforts of expanding the health extension program thereby about 99% of the rural kebele's are covered by HEWs currently (Amhara RHB report, 2011). The empirical material was collected by using various qualitative data collection methods including semi-structured interviews, observations during everyday practices of HEWs and community volunteers, attending meetings, informal discussions and the analysis of documents. The mode of analysis followed some key processes of knowledge generation and communication around the community health care provision and HIS implementations, and how community health workers strive to implement the working guidelines in a resource constraint setting.

1.5 Research Aim and Questions

The aim of this research is to understand how health care workers acquire and integrate context-specific knowledge of the community and how this process may affect HIS and health care provision in the context of a developing country.

The thesis will address the following two interlinked research questions;

- *How can community knowledge be used in the process of health service provision and health information systems in developing countries?*
- *How can communication of community knowledge amongst the public health actors be enhanced in order to contribute in improving health service provision and routine health information systems?*

1.6 Research contributions

This research aims to contribute both to the information systems and public health domains and the following theoretical and practical contributions are envisaged:

- Theoretically, this thesis builds a deeper understanding of the role of community knowledge, which remains poorly explored in the domain of public health service and HIS in the context of developing countries. It also explains the processes of harmonizing knowledge from the community and scientific domains, and tensions that arise from collusion between these two knowledge sources. This thesis also contributes to the notion of communicating knowledge across boundaries.

- The practical contribution includes enhancing and designing strategies for sharing and multiplication of beneficial practices from health workers and the community. This helps to deal with the practical challenges related to the community health service, HIS and the health service planning in developing countries.

1.7 Organization of the Thesis

This thesis comprises of six chapters.

Chapter one provides a background for the present study that include significance of the study, the research motivation, an overview of the theoretical basis of the study, research approach, research objectives and questions, and contributions.

Chapter two presents the research setting that comprises of the profile of the research context, including background information about socio-economic, educational and health status. Specifically, it explains the health extension program implementation and the HIS reform process on going in Ethiopia.

Chapter three presents the literature review and theoretical framework drawn from a review of the literature in the areas of HIS, community knowledge and knowledge communication, and standardization and flexibility.

Chapter four provides a description of the research design and methods. It outlines the use of qualitative research, and explains the reason for selecting and using a case study with an interpretative approach. It also justifies and details the methods of data collection and analysis.

Chapter five considers the research findings based on the summary of five papers included in this thesis. It also discusses the linkages between these papers and the description on the role of HEWs and community volunteers as knowledge brokers.

Chapter six presents a summary on how the research questions formulated in this thesis were addressed. It also provides the contributions of this thesis, both theoretical and practical, followed by concluding remarks.

Chapter Two: The research setting: The Context of Ethiopia

In this chapter, I describe the empirical setting of the study. This contextual background helps to understand the organizational structure of the health sector in Ethiopia. The chapter is divided into the following sections. Section 2.1 presents the geography and demography profile of the country. The socio-economic and education profiles are presented in section 2.2. The health sector and details of the health extension program, which this study focuses on, is provided in section 2.3 and 2.4 respectively. Finally, section 2.5 provides highlights on the HMIS reform process in Ethiopia.

2.1 Geography and Demography

Ethiopia is situated in the horn of Africa between 3 and 15 degrees north latitude and 33 and 48 degrees east longitude. It is the tenth largest country in Africa, covering 1,104,300 square kilometers (with 1 million sq km land area and 104,300 sq km water) and it shares borders with Djibouti, Sudan, Eritrea, Kenya and Somalia in East, west, north, south and south east respectively. The country is divided into three major ecological zones, Kolla (arid low lands below 1,000 meter above sea level), Weina Dega (between 1000 meters and 1500 meters above sea level) and Dega (between 1500-3000 meters above sea level).

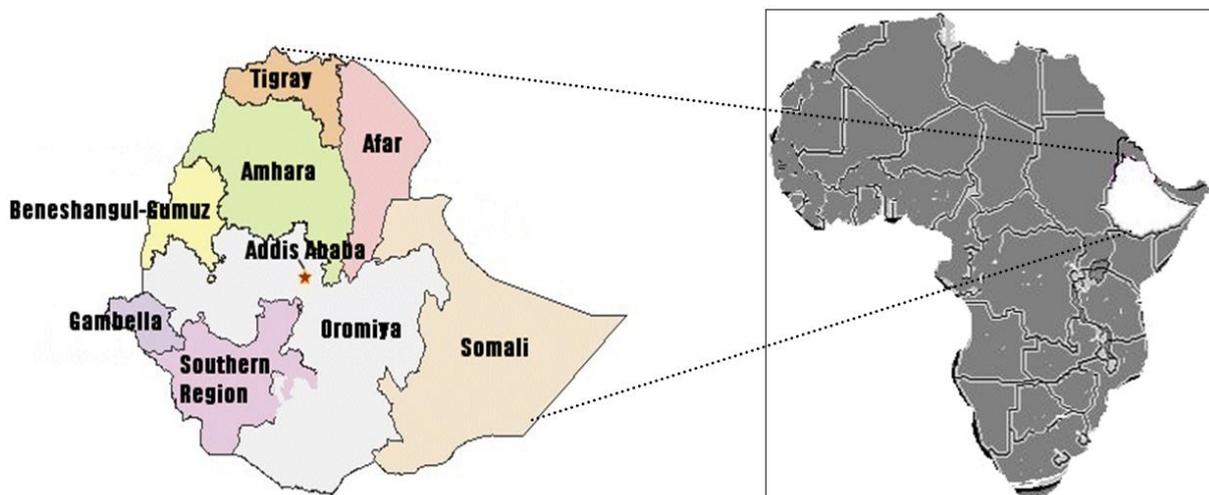


Figure 2.1: Map of Ethiopia and its Regions zoomed in from African Continent

It is a country split by an act of nature, by the cleavage known as the Great Rift Valley. Throughout the ages, the rocky ramparts surrounding its 2500 meter-high (8000ft) central plateau and of course the Ethiopian highlanders prevented countless invaders from ever penetrating beyond the low lands of Red Sea coast. Some twenty-five peaks run above 4000 meter (13,200ft), the highest is Ras-Dashen 4,543 meter (14,538ft). Besides, it has high rugged mountains, deep and forbidding gorges, green hills, rushing streams and wide flowing rivers, lakes, forests and deserts. The major river is the Blue Nile (Abbay), which runs from the largest lake, Tana, for 1,450km to join the White Nile at Khartoum.

Ethiopia still follows the thirteen-month Coptic calendar, instead of the twelve month Gregorian calendar used in most parts of the world. Twelve months each consist of thirty days, and the other five days (six in each leap year) makes up the thirteenth month. The calendar is also seven years and eight months behind from the Gregorian calendar so that 2013 is still 2005/2006 in Ethiopian calendar (E.C.).

The constitution of Federal Democratic Republic of Ethiopia established a federal system of government with 9 National Regional States and two Administrative cities. The regional states as well as the administrative cities are further divided into seventy-five zones, eight hundred nineteen districts (*Weredas*) and around 17, 000 ‘*Kebeles*’¹. The district is the basic administrative unit and has an administrative council composed of elected members. Since 2002, a number of functions have been transferred from the regional to the district level in the context of decentralization. In terms of population, Ethiopia is one of the populous countries in Africa ranking second after Nigeria. According to the projections from the 2007 population and housing census, the population for the year 2012 is about 81 million, with more than 83% living in rural areas. The pyramidal age structure of the population has remained predominately young with 44% under the age of 15 years, and over half (52%) of the population in the age group of 15 and 65 years. The population in the age group of over 65 years accounts for only 3% of the total. Life expectancy at birth is amongst the lowest in the world (53 years for males and 55 for females, and 54 year for both sexes) (Central Statistical Agency, 2012).

It is impossible to understand Ethiopia without considering the diversity of its people. It has multi-ethnic society with more than 80 nations, nationalities and peoples contributing their culture and language. There have been well-established cultures of collaboration amongst Ethiopians. There are historically constituted community-based indigenous institutions that

¹ Kebele is the smallest administrative unit in the system of Ethiopia

promote collective practice on a voluntary basis (Mengesha, 2011). The indigenous institutions that are common across rural as well as urban Ethiopia include “Debo”, “Idir” and “Ikub”. Debo is a labor exchange group; Edir is an association for mutual support in relation to deaths and funerals, as well as supporting elders, the sick individuals and their family; and Ekub is a rotating saving and credit group. The purpose of these community-based indigenous institutions could range from addressing religious/spiritual issues through recreation/refreshment to addressing social and economic challenges (ibid).

2.2 Socio-Economic and Education Profile

Ethiopia is one of the least developed, but emerging countries in the world, where 29.6% of the population are estimated to live below the poverty line (World Bank, 2012). The Ethiopian economy is classified into three categories: the first one is the agricultural sector dominated by peasant agriculture, the second is the livestock sector dominated by nomadic pastoralist and the last is the modern sector which is in the process of coming to the development. Over 80% of the labor force is engaged in the first two sectors. With rapid population growth and the consequent rise in the population/land ratio, farm size per household has been declining over the years and indeed over the decades. Besides, regular droughts combined with poor cultivation practices, make Ethiopia's economy very vulnerable to climatic changes. Despite these obvious challenges, Ethiopia has shown an impressive economic growth and the reduction in poverty has been more pronounced in rural areas than in urban areas (FMOH, 2010).

In spite of the major progresses made in education, the literacy status of the population of Ethiopia is still low. The total adult literacy rate (whose age is above 15 who can read and write) is 36%. According to the Ministry of Education 2010 progress report, the gross enrollment ratio in primary school has risen from 32% in 1990/91 to over 91% in 2006/07, giving a male to female proportion of 55.9% and 44.1%, respectively. This indicates that the gap between school boys and girls has continued to decline. At the higher level, the overall enrollments as well as the intake capacity of the higher education institutions have significantly increased from 138,199 to 304,371 respectively during the period 2004/05 to 2008/09.

Studies have emphasized an intimate linkage between health and education which could potentially reinforce each other towards a rapid socio-economic development of a country. Education is one of the most critical variables in epidemiological and health service research

in Ethiopia and illiteracy is usually associated with high risk and low health seeking behavior (FMOH, 2010). Consequently, the low level of education has a marked influence on the spread of diseases, the acceptability of health practices and utilization of modern health services. Improved female education goes hand in hand with investment in female empowerment. Traditionally, the status of women in Ethiopia has been very low and their health status has suffered with the persistence of unsafe practices, including early marriage and female genital mutilation. There have been significant efforts towards removing legal barrier to women's rights and in emphasizing gender quality in all sectors, although it would take long to address deep-rooted cultural beliefs (Banteyerga et al, 2011). In general, the issues of health cannot be considered in isolation from other socio economic factors including population dynamics, food availability, acceptable living conditions and other requisites essential for health improvement; hence, it demands development of effective intersectoral collaboration for a comprehensive betterment of life.

2.3 Health Sector and Health Problems

The situation of health care in Ethiopia was rudimentary where a large portion of the population used traditional and spiritual healers. In 1896, the Russian Red Cross Society established a treatment facility in Addis Ababa to treat those injured in the battle of Adawa, in which Ethiopian forces defeated Italian invaders (Banteyerga et al., 2011). In 1910, it was replaced by a hospital, which formed a basis for a limited government health system. Elsewhere, health service was provided in clinics and hospitals run by missionaries. The government of Ethiopia established its Ministry of Public Health in 1948.

The PHC approach was introduced into Ethiopia after the World Health Assembly fully endorsed at Alma-Ata Conference in 1978. The current health policy developed in 1993 proposed realistic goals and the means for attaining the fundamental principles of health in regard to its physical, mental and social constituents. Moreover, as part and means of developing the overall socio-economic status of the country, the health delivery system is now undergoing a reform into a more decentralized and cost-effective system. It accords appropriate emphasis to the needs of the less-privileged rural population which constitute the over-whelming majority of the population. Health development shall be seen not only in humanitarian terms but as an essential component of the package of social and economic development as well as being an instrument of social justice and equity.

The health service delivery system in Ethiopia is currently organized in a three tier system

(FMOH, 2010), namely Central and Regional Referral Hospitals, Zonal Hospital and the PHC unit comprising primary hospital, Health Center and Health Post. Central Referral Hospitals give a referral service for 3 to 5 million population. Zonal Hospitals are expected to serve about 1 million population, whereas, primary hospitals for 60,000 to 100,000 populations, including the admission service. Health centers provide both curative and preventive outpatient care to 25,000 population and health posts are the smallest health units serving 5,000 populations, or 1000 households (HH) with more focus on the preventive aspect. Correspondingly, the organizational structure of the health care system of Ethiopia comprises of the Federal Ministry of Health (FMOH), Regional Health Bureaus, Zonal Health Departments, and District Health Offices, with their respective health facilities. This includes Central referral (Specialized) hospitals at the federal or regional level, other hospitals at regional, zonal or district levels, and the PHC unit comprising health centers, and health posts at the district levels (see Figure 2.2).

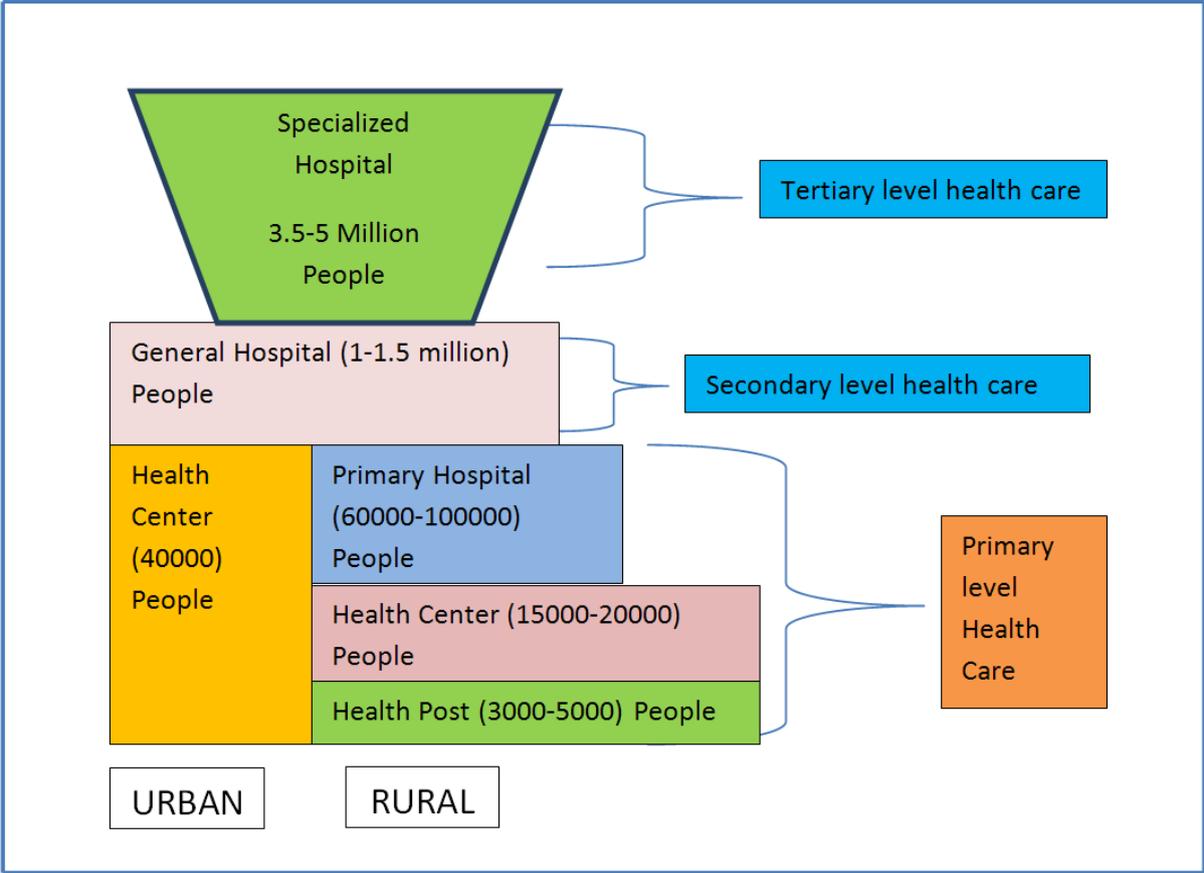


Figure 2.2: Ethiopian Health tier system; source, FMOH, 2010: 78

FMOH is the central coordinator of the health care system of Ethiopia. The main responsibility of the ministry is designing policy issues; developing national strategies, mobilization of resources and capacity building to the regions followed by cascade trainings.

Health services are managed in accordance with the decentralized structures of the country as a whole. Hence, responsibility for the management of health service delivery falls to the respective Regional Health Bureau (RHB), Zonal Health Departments and district health offices. As a result, management of health facilities, personnel, and health training institutions within the regions is undertaken by the RHBs. They are supported in this function by Zonal Health Departments and Wereda (District) Health Offices.

Previously, much of the rural population had no access to modern health care, leading to inability of the health care delivery systems to respond both quantitatively and qualitatively to the health needs of the people. Preventable infectious ailments and nutritional deficiencies are major problems of the country. Widespread poverty along with generally low income levels of the population, low level of education, inadequate access to clean water and sanitation facilities, and poor access to health services have contributed to the high burden of ill-health in the country (FMOH, 2010). Poor nutritional status, infections and a high fertility rate, together with low levels of access to reproductive health and emergency obstetric services, contribute to one of the highest Maternal Mortality in the world (676 deaths /100,000 live births). Maternal deaths represent 30 percent of all deaths to women age 15-49 (Central Statistical Agency, 2012). Ethiopia is also among the countries with high Infant Mortality (59 deaths/1,000 live births), and high under-five mortality (88 deaths/1,000) (ibid). However, the successive Ethiopian Demographic and Health Surveys (EDHS 2000, 2005, 2011) have showed that the mortality rate among all age groups is decreasing, demonstrating a considerable national progress (See Table 2.1)

Table 2-1: Mortality rates at different age groups and maternal mortality ratio in Ethiopia, Source Central Statistical Agency, 2012

Mortalities	EDHS 2000	EDHS 2005	EDHS 2011
Neonatal Mortality rate	54	48	37
Infant Mortality rate	101	88	59
Child Mortality rate	166	133	88
Adult Women Mortality rate	221	217	157
Adult Men Mortality rate	275	207	181
Maternal Mortality ratio	871	673	676

Most deaths occur due to easily preventable and treatable diseases that can be managed at the PHC units. PHC, based upon the WHO Alma-Ata conference declaration was defined as “essential health care made accessible at a cost of country and community can afford, with methods that are practical, scientifically sound and socially acceptable” (WHO, 1978). The Alma-Ata declaration goes on to state that PHC is based on principles of equity, participation by the community, appropriate technology and affordable costs. The PHC approach emphasis was on free services provided through government-supported health care services that were to be expanded to cover the ever increasing numbers of people. However, it was made clear that the cherished goal of free government health services for all was not going to be realized for many poor countries, at least not soon. Reality began then to replace the euphoria of the early days of “Health for All by 2000”, and a closer examination of the PHC record, rightly or wrongly, led many to question its ability to produce the dramatic benefits initially expected of it. Thus, interest began to shift from “Health for All” to other strategies (WHO, 2002), such as the health sector reform.

Accordingly, the Ethiopian government has formulated a 20 year Health Sector Development Plans rolling every five years in line with the Plan for Accelerated and Sustained Development to End Poverty (PASDEP) and to achieve the health-related MDGs (FMOH, 2007). The government plans to realize its health development objectives by the formulation of four consecutive phases of comprehensive Health Sector Development Plans (HSDP); the first (HSDP I) covered the period 1997-2001, the second (HSDP II), covered 2002-2005, and the third (HSDP III) 2005/06-2009/10 were implemented. The fourth HSDP is in the implementation and the midterm review of HSDP IV is being conducted currently.

In the past, public health financing gave priority to the curative sector. This led to a considerable increase in the number of health facilities, but with limited rates of utilization, partly because of lack of physical access (FMOH, 2005). Evaluations of the subsequent HSDPs have also revealed constraints in the access and quality of health services. The new health policy focuses mainly on expanding access and providing quality promotive, preventive and basic curative health care services in an accessible and equitable manner to reach all segments of the population, with special attention to mothers and children. The policy has a particular emphasis on establishing an effective and responsive health delivery system for those who live in rural areas; hence the health extension program was introduced. As part of the privatization policy of the economy by the government, private health facilities have also mushroomed in Ethiopia especially in the urban areas. The presence of these

private health institutions play a great role in sharing the work load of the facilities owned by the government.

Health is a focal element of poverty reduction strategy papers, the program for accelerated and sustainable development to end poverty, and the program for progress and transformation in Ethiopia (FMOH, 2010). Ethiopia has shown low income countries can achieve improvements in health and access to services through the development and rapid implementation of the health extension program. Over 85% of the population now has access to PHC, a figure that has increased particularly rapidly in the past few years following the ambitious health extension program. There is still a great deal to do; but compared to the situation two decades ago, Ethiopia has made considerable progress.

2.4 Health extension program

2.4.1 Expansion of Primary Health Services

Like many other countries in Africa, Ethiopia has suffered a severe shortage of trained health workers (FMOH, 2005). Besides, most of the health facilities in Ethiopia were concentrated in cities with the consequence of unequal access for essential health services, not meeting the demands of health care of the majority. In order to minimize this inequality, a truly community-based approach to PHC delivery was needed to address the vast majority of the population (ibid). The Government of Ethiopia, therefore, launched a health program for the “Accelerated Expansion of PHC Coverage” with the Health Extension Program. It was launched in 2003, initially to be implemented in rural Ethiopia, and then has been expanded to urban areas recently. Health extension program has 16 health extension packages and four major health categories: disease prevention and control, family health, hygiene and environmental sanitation and health education and communication (See Figure 2.3).

The Health extension program is a defined package of basic and essential promotive, preventive and selected high impact curative health services targeting households. Based on the concept and principles of PHC, it is designed to improve the health status of families, with their full participation, using local technologies and the community's skill and wisdom (FMOH, 2007, p3).

Each package is tailored to local needs. For example, in addition to family planning, reproductive health and treating sexually transmitted diseases, family health addresses harmful traditions, like early marriage, abduction of brides, and hazardous delivery practices (Banteyerga et al, 2011).

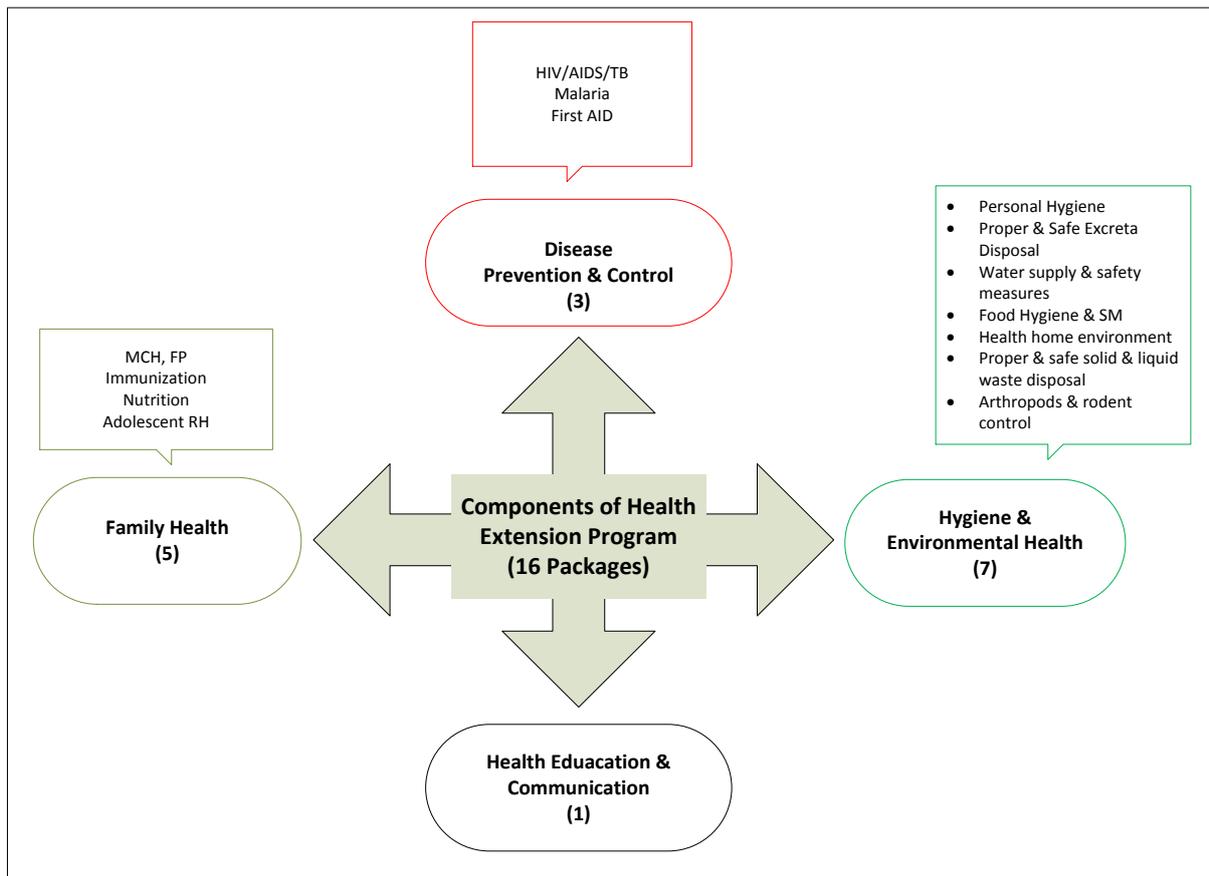


Figure 2.3: Components of the health extension program, adapted from FMOH, 2007

The health extension program is similar to PHC in concept and principle, while it focuses on households at the community level, and it involves fewer facility-based services. It is an innovative community-based approach, as a key priority for the health sector, aimed at creating healthy environment as well as healthful living. The main objective of this program is to improve access and equity to preventive essential health interventions provided at *kebele* and household levels with a focus on sustained preventive health actions and increased health awareness (FMOH, 2005). It also serves as a mechanism for shifting health care resources from being dominantly urban to the rural areas where the majority of the country's population resides. Furthermore, the health extension program is the way of extending basic health care from institutional based to community and household level that create an opportunity to every household to access basic health services. Thus, every family can improve their health status through their active participation and their own actions and efforts to help them to facilitate their journey towards household livelihood security (FMOH, 2005).

The creation of a cadre of HEWs has greatly expanded access to a range of basic, but potentially lifesaving interventions including Vitamin A supplementation, distribution of insecticide-treated bed nets, integrated management of childhood illnesses, basic neonatal

care, and immunization and contraception (Banteyerga et al, 2011). Two female HEWs are assigned at each health post and each village. They are regular government employees and salaried. HEWs are supposed to be selected from the villages that they are supposed to serve. They have to be grade ten completed and speak the language of the communities they would be serving. However, some HEWs are selected from the district towns rather than the rural villages they serve (Kitaw et al., 2007). They are trained for a year in the sixteen health extension packages. Courses for HEWs are held at Technical and Vocational Education Training Institutions(TVETIs) of the Ministry of Education with the support from the health bureau and health service management at different levels. It was clear that an expansion of human power for health to the level it was adequate would take years, especially given the lure of higher salaries and better conditions abroad. Hence the HEWs fill some of the gaps, reaching out to provide basic care for the rural poor.

The health extension program has scaled up rapidly. Although the first workers graduated in 2004, currently their numbers have increased to more than 34,000. When HEWs are deployed to their work place, their first task is to collect the baseline data in their respective villages that includes number of total population, children, and water and sanitation facilities. They continuously update the data and maintain information with them, and they send monthly reports to the district (wereda) health offices and/or cluster health centres. Thereby, they try to capture all health related data in their locality. Figure 2.4: shows a locality hand drawn map and the health status indicators of a rural village prepared by HEWs.



Figure 2.4: Hand drawn map and health indicators of Arsa Gibha rural Kebele

HEWs are most effective when working in collaboration with community volunteers called voluntary community health workers (vCHWs) both to extend contact with families and the community, and to share different skills (Banteyerga and Kidanu, 2008). These community volunteers are members of the community who are early adapters of health actions and volunteer to practice do-able health actions and show to their relatives, neighbours. They are trained by the district health staffs and HEWs (FMOH, 2005). HEWs are required to spend 70% of their time conducting outreach activities by going from house to house. It is assumed that about 60 to 70% of the health problems at community level could be averted by effective interventions at the grass-root level through the health extension program (FMOH, 2005). The health extension program is considered to be a major vehicle to take most of the maternal, neonatal, and child health key interventions to the community. Therefore, it could be considered as the most important institutional framework for achieving the MDGs (FMOH, 2007).

The health extension program is a core component of the broader health system. While the strategies for the interventions focus on the household and community, the success calls for coordinated action at all levels. Health centers in particular have a crucial role to play in providing referral care, technical and practical support to the HEWs. The district health offices similarly have an important role to play in supporting the health centers and health posts. The health extension program in Ethiopia has shown significant positive impacts on the health of communities, in disease prevention, family health, hygiene and environmental sanitation (Banteyerga and Kidanu, 2008). As all the HEWs are females, it is expected that they will maintain good relationship particularly with mothers. This has its own impact to improve maternal and child health, and thus increase utilization of health services, such as immunization services. In addition, it creates more than 34000 jobs for women at grassroots level (FMOH, 2007). The following excerpt from the Minister of FMOH can explain the benefits:

Being a female is an important attribute. As women in service, they understand the challenge that women have to go through in Africa, so there is this strong desire to support their fellow citizens. I think that Maternal and Child Health are strongly linked with having a robust health system and if the HEWs are part of that system, as women themselves, I am sure that they would be able to help support the women in the community. (Source: www.jhsph.edu/...health/.../KeseteTranscript.pdf , accessed on 03/05/2013).

2.4.2 Health Extension Program implementation in Amhara Region

In Amhara region, near to 99% of rural *kebele's* are covered by HEWs. The two female HEWs are responsible for population of one *kebele* that is an average of 1000 households. Each rural *kebele* also supposed to have 20 community volunteers who support the HEWs. The average household size is expected to be five, thus the average population of one *kebele* is estimated to be 5,000. In this regard, one community volunteer will be accountable for average 50 households near to his/her vicinity. Consequently, each HEW, in cooperation with ten community volunteers, are accountable to give service for 500 households or 2,500 population. When the number of population exceeds about 7,000 in a given *kebele*, the district health office has deployed 3 to 4 HEWs. According to our observation during field visits, community volunteers were seen to work in cooperation HEWs. For example, a HEW explained the role of community volunteers in defaulter tracing of the immunization service as follows;

“We identify defaulters from the immunization register, list out them and give the list for community volunteers according to their vicinity; it is then easy for them to retrieve the absentee, convince the parents and bring them back for the service”. Feb, 2008.

All HEWs are expected to offer a special close support for about 50-70 households from the residents of their respective villages (*kebeles*) recurrently, and encourage and help them to implement the required extension packages in one year's time. Households, who have implemented most of the health extension packages, are considered as graduated family and get a certificate award for their good performance. The award is sometimes given in the ceremony in front of villagers in that particular community and invited guests. This is done with the intention of motivating others. Figure 2.5: shows the graduation ceremony at one rural *kebele* in Dangla district, where the researcher attended with her research advisor.



Figure 2.5: The family graduation ceremony at Bacha kebele, Dangla district

As the Amhara RHB report, there are some observable economic and social changes in rural villages. These changes are the results of not only the health organization but also other sectors that work together to produce social and economic change in the community. The health extension program is supposed to be implemented in an integrated manner. It required the cooperation of rural dwellers that include primary school teachers, agriculture development agents, HEWs, community volunteers, and households, as well as, the local resources and wisdoms (ANRSHB annual report, 2011).

Recognizing the magnitude of the need for public sector services and the importance of making optimal use of scarce resources to meet those needs, the Government of Ethiopia and the FMOH have introduced fundamental changes in organizational structure and management in recent years (FMOH, 2008). Since, 2006, the FMOH is applying Business processing reengineering (BPR) techniques throughout the organization to more effectively and efficiently meet its goals, including the HIS reform, which I now present.

2.5 HIS Reform in Ethiopia

It is known that availability of reliable, relevant, comprehensive and timely health information is an essential foundation for any public health interventions. However, very few systems in developing countries meet that demand (Lipeveld, 2000). Several HIS researchers mentioned that the HIS in developing countries have been considered obstacles that hinder the provision of quality health services rather than supporting tools. Different reasons have been identified problems of HIS in developing countries. For example, as FMOH (2006) has put it, the lack of coordination, leadership, clear strategy, policy and guidelines, as well as shortage of skilled human resources, were key constraints to HIS performance. Furthermore, the effect of parallel

reporting with multiple and redundant formats has compromised data quality and increased administrative workload. Data were collected primarily for reporting, and use of data was very limited at lower levels (ibid).

In Ethiopia, with the exception of some vertical programs driven by donors, there were no standard instruments to collect information when clients and patients interact with care givers. Damtew et al., (2010) has pointed out the major constraints to the HIS in Ethiopia that included problems related to data collection tools, basically manual and characterized by high fragmentation and cumbersome data elements with duplication of efforts. The consequence is that the same information may be recorded several times, creating a large data burden, yet the care provider may lack essential information on other services provided (FMOH, 2008).

Recognizing the weaknesses of existing routine paper-based system, there is an effort to reform the HIS in Ethiopia. It is recognized that an efficient HIS, would play a crucial role in successful implementation of the national HSDP. Hence the HIS reform is taking place with the objective to support continuous improvement of health services and the health status of population through action-oriented, evidence-based decision making, based on quality information (FMOH, 2008). Accordingly, since 2006 the FMOH has initiated major reform of the HIS (FMOH, 2006).

HIS is one of the priorities of HSDP III. The objectives of HIS in HSDP III were to develop and implement a comprehensive and standardized national HIS and to ensure the use of information for evidence-based planning and management of health services (FMOH, 2010).

The main objective of the HIS reforms is directed towards supporting and strengthening local action-oriented performance monitoring. Accomplishing this objective requires a paradigm shift from simply reporting data and responding to the situation as instructed by higher authorities, to analyzing and interpreting the information, and self-assessment and problem-solving. Introduction of Information Communication technology (ICT) and an electronic HIS at all levels in the health care hierarchy will considerably enhance the ability to transfer data quickly, accurately, and efficiently. In addition, use of ICT expands the range of data presentation and the analysis options enormously. However, given the current fragility of infrastructure and ICT support in peripheral areas, the HIS system will first need to prove itself as a clean and reliable manual system that can be used as a fallback in case of ICT failures.

Thus, one of the main tasks of the HIS reform was to establish client/patient encounter recording formats, including household and community records, that conforms to standards for service delivery and that contains the information required for continuity and quality of care (FHOM, 2008). The first principle for designing client/patient recording instruments is that a register is needed to record each attendance for preventive and curative services; this meets legal requirements for tracing care and responds to the need for financial accountability. In order to harmonize the information needs of all data consumers, a standardized set of indicators will be collected and reported, based on standardized forms, and reported through an integrated channel from all health facilities, including the health posts where HEWs are assigned.

At the community level, the family folder has been designed as a comprehensive data collection and documentation tool to be used by the HEWs. It is the community based information tool which was designed according to the principle of standardization, integration and simplification to provide information for decision making (FMOH, 2008). The family folder was piloted first at four health posts throughout the country; located in Amhara and Southern regions, with two in each region. Currently, the family folder is expanding to all health posts as a data collection tools for HEWs.

Another key strategy to address the problems encountered the HIS of developing countries, is improving the staffing structure through establishing pre-service and in-service HIS trainings (FMOH, 2008). It is known that a well-trained work force is a crucial endeavor in order to ensure adequate coverage and quality of service in terms of both HIS and health services provision. Thus, different universities, for example, Addis Ababa, Jimma and Gondar universities in Ethiopia have started to offer in-service and pre-service trainings on HIS. For instance, the University of Gondar, in collaboration with the University of Oslo began a rapid and consolidated postgraduate training programme of Masters in Public Health in information systems track in 2008, The researcher participated in teaching and designing the courses. The Master program focuses on more specific public health interventions and HIS issues pertaining to gathering, analyzing, and transferring and utilizing public health data. This Masters program is designed mainly to train public health managers and IT specialists in the field of HIS. Further, the aim is to train professionals who would manage health services and programs at the district, regional and national levels; teach in public health training programs; and undertake HIS and public health researches that inform programs and policy. The graduates, with this acquired knowledge of public health and HIS, as well as, enormous

experience in the health care system, expectantly will play crucial role to improve the HIS of Ethiopia, and also other developing countries, for example, through conducting empirical researches.

Chapter Three: Literature Review and Theoretical framework

This chapter provides an overview of the literature reviewed and the theoretical insights that were used to analyze the findings of the study. The first section provides a background literature review of community health service and information systems, and the generation, characteristics and use of community knowledge. The second section presents the theoretical perspectives. These embrace perspectives on knowledge sharing, communicating knowledge across boundaries, knowledge broker and the integration of knowledge bases from community and scientific sources. Issue of standardization and flexibility are also included in this section. A brief review of these concepts provides a framework for the discussion of how community knowledge can be used and communicated in the public health sector of Ethiopia.

3.1 Health information systems and community knowledge

3.1.1 Community information systems

Reliable and timely health information is the key to the enhancement of an effective HIS which contributes to improvements of the health condition of a given country. However, studies have showed that HIS of most developing countries are cumbersome with the repetitive nature of the data registration processes, staff lacking adequate skills in data collection and analysis ultimately leading to poor quality of data (Lippeveld and Sauerborn; 2000). Moreover, the information flow is fragmented including parallel reporting system with no integration among the various subsystems, resulting in redundant and conflicting reports (Chilundo and Aanestad, 2004; Damtew, 2005). Being one of the developing countries, Ethiopia is not an exception. For example, Mengistie (2010: 15) summarized the feature of routine paper-based HIS in Amhara region, Ethiopia as follows: “Fragmentation of data collection tools and reports; inconsistency and redundancy of reports; no feedback mechanism; inadequate qualified manpower; and inappropriate use of available resources”.

In addition, most literature about HIS in developing countries indicate 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 the nations HIS (Shaw, 2009). Currently, the governments’ policy of most developing countries emphasizes provision of health services within the practice of health reforms. It has been noted that the focus of health care, driven by various initiatives, has been shifting from the hospital to clinic based

care, and from an individual approach to comprehensive, community based care (Starfield, Shi, and Macinko, 2005). Ideally, community health service may provide opportunities to increase both the effectiveness of curative and preventive services and community health workers may act as a bridge between the community and the formal health services in all aspects of health development (WHO, 2008).

Since community health workers provide the extension of health services to the community and household level, there is an opportunity for strengthened data collection at the household level. They collect data through household visits, such as, vital events, burden of diseases, and coverage levels of essential interventions such as immunizations, pregnancy care and skilled delivery of newborns (Center for Global health and Economic Development, 2011). The data gathered by these peripheral level health workers linked with national data systems provides countries the means with which to effectively set the target for the health services, and allocate scarce resources efficiently that in turn may improve integrated community health and PHC (Otieno, 2012).

The collection of health data is important not only at the health facility level, but also at the community level, given that the majority of deaths and illnesses never reach the health facility and so frequently go unreported (Kanjo, 2012). Currently, the trend is changing and community health workers are playing an important role in capturing health related data in many developing countries. For instance, they have been used to collect data for screening of tuberculosis, achieving high rates of case detection in Bangladesh. A community based HIS program in Kenya captures community health data at the grassroots level through voluntary community health workers (Otieno et al., 2012). This information is used by the district health authorities to direct their resources and services to where these are most needed. Simultaneously, community health workers are able to analyze the information and present it to their communities, educating them on health issues common in their village, and empowering them to take control of their own health. Malawi also attempted to link the data collected from the traditional health sectors with modern health sectors through community health workers (Katsulukuta, 2010). However, the link is not working effectively in practice due to different constraints, such as community health workers being overloaded with jobs other than data collection, and TBAs stopped recording data of births and deaths because of changes in policy which changed their roles (Kanjo, 2012)

Research indicates poor linkages of community health information with the national information systems (Center for Global health and Economic Development, 2011, Kanjo,

2012) that result in incomplete data being reported. It is also mentioned that lack of appropriate skills of community health workers on data management sometimes affects the data quality generated at the community level. Hence, strengthening the crucial link of the community health data to national information systems, and offering the required training to community health workers is recommended. WHO (2008) also points out that, the community health workers programs are neither the panacea for weak health systems nor a cheap option to provide access to health care for underserved populations. Numerous programs have failed in the past because of unrealistic expectations, poor planning and an underestimation of the effort and inputs required to make them work.

Community health workers mostly do their work in cooperation with the community, and base their work on community knowledge (Damtew, 2010; Kanjo, 2012). Thus, understanding the working practices of these peripheral level health workers and the community knowledge can give a clue to reform the community health service programs based on the reality at the ground.

3.1.2 The Community Knowledge: Characteristics and Generation

Different researchers have described that groups of people mainly in rural areas adapt and develop ways of doing things that are called ‘traditional or indigenous’ using their knowledge in agriculture, food harvesting, traditional medicine and related purposes, as means of subsistence activities (Fernandez, 1994; Rengalakshmi, 2006; ICSU, 2000; Zane Ma Rhea, 2004). These people are commonly part of the same ethnic or cultural group that form the national majority and have developed adaptations of knowledge that are considered to be important to protect and preserve their environment. Rajasakeran et al., (1992) defined this knowledge domain as a systematic body of knowledge acquired by local people through the accumulation of experiences, informal experiments and intimate understanding of the environment in a given culture. This knowledge is known by different names such as “indigenous knowledge”, “community knowledge”, “rural peoples’ knowledge”, “traditional knowledge”, “indigenous science” and so forth. In this thesis, I have chosen the terms indigenous or community knowledge, because the premise of this study deals with the community health care provision and information systems. Indigenous refers more strictly to traditional practices. The term community knowledge as used in this thesis is the knowledge of a community of a particular rural area based on their interactions and experience within that area, their traditions, and their incorporation of knowledge emanating from elsewhere into their everyday activities.

The community knowledge is seen to be based on experience, often tested over centuries of applications, passed down through generations, and adapted to local culture and environment (International Institute of Rural Reconstruction, 1996). This kind of knowledge is embedded in a context and is dynamic as new knowledge is continuously added through internalization and adaptation of external knowledge to suit with the local situation (Mathias, 1994). It is the consequence of practical engagement in everyday life, and is constantly reinforced by experience and trial and error. It is, therefore, constantly changing, being produced as well as reproduced, discovered as well as lost; though it is often represented as being somehow static.

This knowledge is generated and transmitted by communities, over time, in an effort to cope with their own agro-ecological and socio-economic environments (Fernandez, 1994). It is generated through a systematic process of observing local conditions, experimenting with solutions and readapting previously identified solutions to modified environmental, socio-economic and technological situations (Brouwers, 1993). The community knowledge is passed from generation to generation, usually through conversations or oral communication, observations in the field, folk songs, metaphors, and so forth. Most indigenous communities have traditional songs, stories, legends, dreams, methods, and practices as means of transmitting specific elements of their knowledge.

Community knowledge has been the basis for agriculture, food preparation and conservation, health care, education, and the wide range of other activities that sustain a society and its environment in many parts of the world for many centuries. For instance, in his study of the indigenous knowledge in India, Rengalakshmi, (2006) described that the ritual of “ceremonial plowing,” where all of the farmers in a village come together and initiate the first plowing. This traditional practice or ritual communicates to the entire community about the onset of rain. The predictions also help to determine the appropriate cropping pattern for the season. If the rainfall is normal, farmers plant high-value crops with high-yielding varieties, however, if the rainfall is forecast to be below normal, they are more likely to plant short-duration, drought-resistant pulses and small millets. The author mentioned that farmers have been using different strategies to adapt and cope with uncertain weather and climate based on their experience and acquired knowledge from previous generations (ibid).

Indigenous knowledge is a way of life. It contains information collected over time. This form of knowledge differs from scientific knowledge in the way it explains and establishes knowledge claims (Millennium Ecosystem Assessment, 2003). Contrary to the indigenous knowledge system that is mainly based on one’s experience (Ellis, 2005), the scientific

knowledge is essentially in explicit format; can be articulated in formal language including grammatical statements, mathematical expressions, specifications, manuals, and so forth. This kind of knowledge thus can be transmitted across individuals formally and somewhat easily (Rahman, 2000). The community knowledge is usually asymmetrically distributed within a population; by gender, age and occupation, and preserved through distribution in the memories of different individuals. Specialists may exist by virtue of experience (Ellen and Harris, 1996).

Therefore these knowledge systems have not been systematically recorded in written form and are not readily accessible to agricultural researchers, development practitioners, and policy makers. Recently, some workers have shown their interest on indigenous knowledge and they have provided a detailed overview (Warren, 1991; ICSU, 2000; Alan 2000). Unlike a formal education system, there are no certificates or degrees by which to judge if an indigenous person has a high degree of skill in traditional ways. All people in the community, however, hold at least some form of this knowledge (Alan, 2000).

This knowledge is embedded in the experiences of indigenous or local community and involves intangible factors, including their beliefs, perspectives, and value systems (Alan, 2000). Nicholson and Sahay (2004) also take the viewpoint of embeddedness of knowledge in the context. This was also the case in Kaasbøll's (1987) study where he showed that nurses have relatively stable knowledge about their patients, since patients mostly stay for more than one shift. Therefore, they have a "total picture of the patient," achieved through care, medication, reporting and discussing, enabling them to react adequately to emergencies in the absence of documentation.

For this thesis, scientific knowledge is understood to be knowledge with origins outside of the rural communities in Ethiopia. The scientific knowledge may not necessarily consist of hard scientific data, but rather of tried- and tested-tools, methods or materials developed 'outside' but which are immediately accessible to an indigenous community. It refers to all scientific principles, strategies, and approaches and institutions such as conventions, government policies, strategies, rules and regulations (Mercer et al., 2009).

3.1.3 Utility of the Community Knowledge

Community knowledge has a broad perspective of the ecosystems and of sustainable ways of using natural resources (Brouwers, 1993). However, this knowledge, while being a dominant form of knowledge in developing countries, is excluded from such discourses because it is not

considered relevant or important, and often not knowledge at all, by the more powerful (Puri, 2003). In his study of the Geographic Information Systems (GIS) in India, the author described that scientists tend to problematize land degradation in scientific terms that can be addressed using knowledge generated through technical and scientific approaches such as remote sensing and GIS modeling. However, the knowledge expressed through these abstract representations do not take into account the more local factors that lead to degradation, and the interventions suggested on the basis of such scientific knowledge hence tend not to be accepted by the community at the field level (ibid).

Rhea (2004) also stated that although education involves the use of societal knowledge that contributes to curriculum content, the absence of documentation on indigenous knowledge has made schools and training institutions to ignore it. The author indicated that the knowledge of local communities is failing to become embedded in national education systems because it was seen as being of lower order knowledge when compared to the superior scientific knowledge system.

Despite this, the trend is changing and many international development agencies, government sectors, universities, and research institutions have begun to emphasize more strongly the value of community knowledge in development (ICSU, 2000). This knowledge continues to play a major, even if largely unrecognized, role in the modern world. For example, the pharmaceutical industry still uses knowledge of traditional medicines to develop modern drugs. And interest in the use of indigenous knowledge has surged in such areas as agriculture and the conservation of genetic resources (ibid).

The International Council for Science (ICSU) recognizes the value of indigenous knowledge of the local peoples of the world. This international science organization agrees that some of the science contributions like classification of animals was partly adapted and adopted from indigenous people, whereby, their extensive knowledge of plants and animals were a source for compiling the extensive list for classifying living organisms. The ICSU (2000) report indicates that the indigenous community accumulated knowledge about medicines, some of which have been upgraded using scientific techniques.

(Rengalakshmi, 2006) also mentioned that farmers in India have used the community knowledge to understand weather and climate patterns in order to make decisions about crop and irrigation cycles. This knowledge is adapted to local conditions and needs and has been gained through many decades of experience passed on from previous generations. The author mentioned that men and women have different kinds of knowledge and use it for different

purposes. Farmers as well as agricultural laborers have their own indicators that are based on their own needs and experiences. Maasai people of Tanzania also predict droughts as well as weather related diseases by watching the movements of celestial bodies in combination with observing the date of emergence of certain plants. Such early detection of an approaching environmental disaster is used to determine any preventive measures (Emery, 2000). The author also mentioned that, in Cameroon, diseases are now being treated using effective remedies that were used by local communities many years before the arrival of modern drugs. The practice depends on indigenous farmers' knowledge. Modern drugs complement indigenous ones and are used for certain diseases if no effective indigenous remedies are available.

Indigenous knowledge has also an immense value in education (Senanayake, 2006). The author has indicated that the indigenous peoples' traditional model of education is an acceptable model to the local community. It is an education system gradually developed from the accumulated knowledge of many generations. It leads to the development of a whole person in a dynamic family and community context (ibid). It incorporated principles of holism, integration, respect for the spiritual and natural world order, and the balance. On an individual scale, it encompassed the total preparation of the total person for living of a total life (Obomsawin, 1988). It is very clear that there is much to be learned from the indigenous knowledge systems of local community (Senanayake, 2006). If we are to move towards interactive technology development from the conventional transfer of technology approach, we all may have to learn many things from our village level experts, the gurus of indigenous knowledge (ibid). Besides, when a community has already identified a problem; its members have also tried to devise their own solutions to it (Brehony, 2000). In general, development initiatives need to draw on the rich body of knowledge that community members have acquired. Hence, involving the local community is crucial for effectiveness of implementation and sustainability of the system (Puri 2003, Piotti et al 2006).

As Reij, Scoones and Toulmin (1996) put it, although local knowledge and practices of a particular community certainly exists; they are inevitably mediated by external influences from migrants, extension workers, visiting businessmen and so on. In a similar vein, Ostberg (1995) stresses the importance of 'outside' sources of knowledge and the interplay of outsiders' and the local community knowledge to produce a mediated and provisional knowledge. Puri (2007) also demonstrates ways of combining different kinds of knowledge

that can help to develop a more effective strategy to combat the larger problem of land degradation in India.

3.2 Theoretical Framework

This thesis draws from the following theoretical perspectives in order to explicate the use of community knowledge in the public health sector and the knowledge communication among the public health actors.

3.2.1 Perspectives on Knowledge Sharing

Many scholars have investigated knowledge sharing across groups and organizational boundaries. Alavi and Leidner (2001) have stated that knowledge is information processed in the minds of individuals and knowledge becomes information once it is articulated and processed in the form of text, graphics, symbols or words. However, the sharing of knowledge is more difficult than sharing of information because of the tacit nature of knowledge. Polanyi (1967) and latter Nonaka (1994) and Nonaka and Takeuchi (1995) identified two dimension of knowledge: tacit and explicit knowledge. Zach (1999) describes tacit knowledge as subconsciously understood and applied, difficult to articulate, developed from direct experience and usually shared through highly interactive conversation, storytelling and shared experiences. Tacit knowledge is therefore all about personal beliefs, attitudes, values and experience (Kakabadse et al., 2001). Explicit knowledge, on the other hand, is codified, articulated and communicated knowledge. This knowledge can be stored in various formats, and communicated verbally, electronically and in written forms. Some researchers have been critical of a purely taxonomic perspective, arguing that it reifies knowledge by treating it as a stock or set of discrete elements (Orlikowski, 2002).

Nicolini et al. (2003) divided these studies into three groups: One group; is of applied individual psychology to explain organizational studies and view knowledge as being the codification of experience, and “organizations are equated with entities that process information, reflect on experience, and in this way acquire knowledge”. The individual psychology approach conceives of knowledge as the codification of experience in some form of cognitive structure or behavioral pattern, and of learning as the process through which such structures and patterns change. Another group perceived knowledge as being an immaterial substance that can be “taken out of context, recorded, classified, and distributed” (Nicolini et al., 2003:5-6). As Gherardi (2000:212) has stated: “as if it were food or money, this perspective implies, knowledge exists prior to and independent from the knowing subject”.

The last group was influenced by economic theories, and considered knowledge to be intellectual capital that can be “quantified, estimated, accumulated, and exchanged as a high-valued commodity” (Nicolini et al., 2003:6).

In this case, knowledge is reduced to something very akin to information that can consequently be stored, retrieved, and processed by modern communication technologies. Conversely, in a practice-based standpoint, learning and knowledge are viewed as being social and cultural phenomena. Thus, the conceptualization of knowledge as an object instead of a process: that is, as a mental substance mainly located in individual minds and manifested in written texts, representations, and routinized behavior is restrictive (Nicolini et al., 2003). Hence social interaction assumes a much more important role: instead of being a “pipeline” for the transfer of knowledge produced at one location and consumed at another, it forms an important condition for the possibility of knowledge sharing. As Lave (1988:313) stated: “knowledge is not primarily a factual commodity... it takes on the character of a process of knowing”. Similarly, Orlikowski (2002) discusses knowledge as a practice. She recognizes “knowing-as-doing” or “knowing-how” as opposed to “knowledge as object”. Carlile (2002) also takes into account the practice-based view of knowledge. The author argues that ‘knowledge is invested in practice’ (Carlile, 2002). And "knowledge in practice" makes working across functional boundaries and accommodating the knowledge developed in another practice especially difficult. This perspective is also relevant for my study of everyday practices of HEWs and community volunteers in the rural community.

Carlile (2002; 2004) develops a framework for understanding different knowledge boundaries through examining knowledge boundaries of varying complexity and showing the different challenges and means required to bridge the different types of boundaries. The author provides analytic descriptions of the varying circumstances possible at boundaries and the processes involved in managing knowledge across them. He described three different perspectives on boundaries: an information processing approach that focuses on knowledge as a thing to store and retrieve; an interpretive approach that emphasizes the importance of a common meaning to share knowledge between actors, and a political approach that acknowledges how different interests impede knowledge sharing. The succeeding subsection discusses the nature of the three knowledge boundaries and communicating knowledge across these boundaries.

3.2.2 Communicating Knowledge across Boundaries

This thesis deals with the notion of knowledge communication across boundaries between communities. These communities consist of public health actors from different specialized domain that include HEWs, community volunteers, TBAs, health workers and health managers and rural dwellers. The notion “knowledge boundaries and communication” identifies the importance of dealing with multiple boundaries simultaneously. According to Carlile (2004: 2002), communicating knowledge across three progressively complex types of boundaries: syntactic (structure), semantic (meaning), and pragmatic (practice), requires different processes that include transfer, translation and transformation. The author argued that difference, dependence and novelty of domain-specific knowledge among people at the boundary determine the complexity of communicating knowledge. Thus, Carlile (2004) proposes that increases in the difference, dependence, and novelty of domain specific knowledge between people creates progressively complex boundaries of conveying syntactic, semantic and pragmatic understandings of communication between actors. Table 3.1 describes the difference, dependence and novelty of domain-specific knowledge.

Table 3-1: Description of three properties of knowledge boundaries, according to Carlile (2004:238)

<i>Properties of knowledge boundaries</i>	<i>Description of proprieties of knowledge boundaries</i>
<i>Difference</i>	<i>Refers to the unique amounts of knowledge (example, as between novices and experts) and types of specialized domain specific knowledge of people at knowledge boundary. As difference in domain specific knowledge increases among people, the effort to access and share each other’s knowledge increases.</i>
<i>Dependence</i>	<i>Is the degree to which people across boundaries perceive they consider each other’s views if they are to meet their goals. The coordination of dependence among people at the boundary requires a capacity to develop a common knowledge as resources and task changes. The greater the interdependence, the greater the coordination required through more intensive and rich communications.</i>
<i>Novelty</i>	<i>Refers either to a lack of common knowledge due to different cultures and context of people at the boundary, or to new domain specific knowledge. As novelty increases, the complexity and amount of effort required to share and access knowledge is also increasing.</i>

The analysis of Carlile “knowledge boundaries and communication” is based on other prominent writers, such as Shannon and Weaver (1949) who developed a syntactic approach

to boundaries with their establishment of a mathematical theory of communication. Accordingly, once syntax is shared and stable across a given boundary, processing of information becomes the primary concern. For the authors, establishing a shared and stable syntax meant that they could ensure accurate communication between sender and receiver across a boundary that enables the knowledge communication. This information processing perspective of dealing with a boundary also had significant impact on the social sciences, for instance; Buckley (1968) revealed information processing at the boundary between an organization and its environment as a problem. The knowledge transfer focuses on one-way movements of knowledge, learning, or practice from one place to another or from sender to receiver (Argote, 1999; Szulanski, 1996). For instance, in the health care sector, when a new treatment schedule is introduced for some diseases, such as malaria, the procedure will be presented to the respective health workers through different mechanisms. For instance, training will be given to representative health workers from various health facilities, and then the trained health workers introduce the new treatment schedule to their staff, which may denote knowledge transfer. It indicated that knowledge transfer takes place between people with similar backgrounds and sharing practices and thus having a common lexicon that sufficiently specifies the differences and dependencies of consequence at the boundary. When differences and dependencies are known and the conditions surrounding them are stable, managing the boundary is straightforward (Carlile, 2002; 2004). Successful movements of knowledge occur when the parties are specialized in the same type of practice, so the primary difference is only that the sender is experienced in the best practice and the receiver is not.

However, “when novel conditions emerge will the current syntax be sufficient to process information at the boundary? Then the problem shifts from one of processing more information to understanding these novel conditions or new knowledge that lies outside the current syntax used at the boundary that require a semantic approach” (Carlile, 2002: P444). Whilst a common lexicon is always necessary, it is not always a sufficient type of common knowledge to share and assess domain-specific knowledge. The semantic boundary describes the circumstances when a syntactical approach is no longer sufficient, wherein a common syntax or language is present, but interpretations are often different which makes communication and collaboration difficult. Dougherty (1992) discussed a semantic perspective in which differences in meaning or language across functions in product development remain challenging. Nonaka and Takeuchi (1995) also recognize the challenges of “conveyed meaning” and the possible different interpretations by individuals, and

emphasize those practice-specific aspects of creating and translating knowledge must be taken into consideration.

The key features that distinguish knowledge transfer from translation are conversations, sense making, and collaboration among actors. In the health sector, for instance, the conversations and negotiations of health managers on budget allocation for different health programs can signify the knowledge translation. For example, health program managers at the national and regional levels may hold meetings and discuss about the health budget distribution to different health activities. Some health managers may intend to get more money for their health programs. Then, after conversations and negotiations, they will reach to common understanding, agreement and decision. When new requirements are present, interpretive differences limits the effective management of knowledge between actors. Interpretive approach emphasizes processes that help create “shared meanings” (Dougherty 1992) or mechanisms “to reconcile discrepancies in meaning” (Nonaka and Takeuchi 1995). From a practice standpoint, if actors have previously accumulated shared knowledge in practicing together at the boundary and the boundary remains stable, then managing the differences and dependencies will be much less challenging. Through collaboration the participants produce common meanings and coordinate local agreements (Carlile, 2002; 2004). Some consequences are resolved by creating shared agreements. The ability to represent and specify differences and dependencies allows the different groups to identify what is most consequential, and then collectively prioritize their time and resources to resolve those consequences.

However, Carlile (2002; 2004: 444) further argues “learning about differences is not always enough to deal with every knowledge boundary; in some cases by making one’s knowledge explicit the potential conflicts and costs associated in working across a boundary are made more explicit”. Hence, the author proposes the pragmatic knowledge boundary by taking the perspective of a pragmatic approach (James, 1907), which highlights the importance of understanding the consequences that exist between things that are different and dependent on each other. A pragmatic boundary assumes transforming knowledge that refers to a process of altering current knowledge and creating new knowledge (Carlile; 2002; 2004). A pragmatic approach assumes the conditions of difference, dependence and novelty are all present, and requires an overall process for transforming existing knowledge. Carlile emphasizes that pragmatic boundaries influence not only how different kinds of knowledge produce novelty, but also how dependence across these differences generate consequences. When actors have

different interests, and depend on each other to accomplish a given task, the knowledge developed in one domain may produce a negative consequence in another that can only be resolved if groups on one or both sides of the boundary change the knowledge they use.

It is a pragmatic process, which needs transforming a mix of knowledge currently used with more novel forms of knowledge being identified at the boundary (ibid). Bolman and Deal (2003) also indicate that changing of the usual routine can face resistance at different levels, hence change in the usual practice and procedures undermine the existing knowledge and skills. Carlile (2004) points out that managing knowledge at the pragmatic boundary requires multiple iterations. For instance, during their day-to-day practices, HEWs in Ethiopia help households to implement the innovative health extension packages, albeit households may not realize the anticipated activities immediately. HEWs are expected to appear frequently in the respective families and make repeated conversations, demonstrations and negotiations until the families perform those activities. Hence, communicating at more complex boundaries requires the capacity below them. For example, knowledge translation assumes knowledge transfer, and knowledge transformation requires knowledge transfer and knowledge translation processes (ibid).

People in rural communities with an indigenous culture and health workers with scientific background have significantly different domain-specific knowledge, and they depend on each other to accomplish the task related to the health extension packages. If knowledge is different in kind, and not just in degree, then managing dependencies requires the capacity to develop an adequate common knowledge as resources and tasks change. Being the most important distinction in this study, pragmatic borders exist between practices from different knowledge systems.

Carlile (2004) uses an inverted triangle to show how increases in the difference, dependence and novelty of knowledge among people at the boundary create communication difficulties as shown in Figure 3.1. The author also identified the following four characteristics of a pragmatic boundary capability that facilitate effective boundary process and knowledge communication: 1) establish a shared language to represent knowledge; 2) provide a concrete means of specifying differences and dependencies; 3) facilitate a method in which individuals can jointly transform the knowledge used and 4) the need of multiple interactions (see Figure 3.1.).

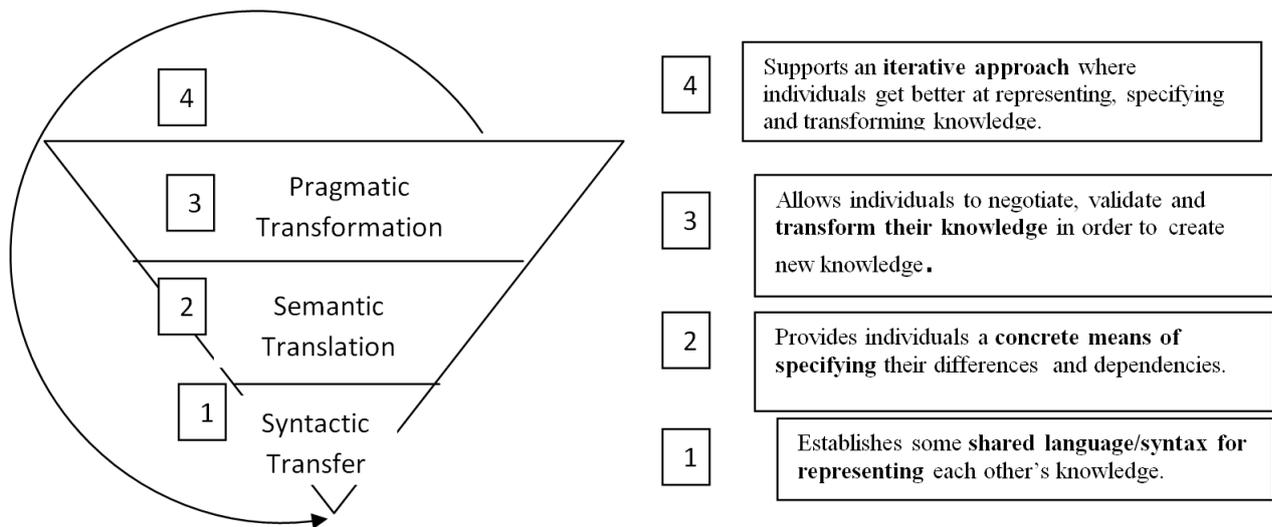


Figure 3.1: 3-T Framework and the Four Characteristics of a Pragmatic Boundary Process, adapted from Carlile (2004: 563)

In the above Figure, the tip of the inverted triangle represents the situations where the syntax is shared and sufficient, so knowledge can be transferred across the boundary. As novelty increases and the gap grows, new differences and dependencies arise that require semantic boundary crossing to create new agreements. However, as novelty continues to increase and the gap gets larger, a pragmatic boundary is faced.

Although the line between each type of boundary is clearly demarcated in Figure 3.1, the transition where one ends and another begins is not often easily identified by the actors involved (Carlile, 2004). Further, the purpose of the hierarchical representation in Figure 3.1 is to recognize that as we move up in complexity, the process or capacity at a more complex boundary still requires the capacities of those below it. For example, an effective transformation process also requires the existence of a common lexicon and meaning. Generally, increases in difference, dependence and novelty of the knowledge domain of people at the boundary create syntactic, semantic and pragmatic communication difficulties, and hence contribute to progressively more complex forms of communication that include transfer, translation and transformation (Carlile, 2004).

The knowledge boundaries which Carlile argues exist in communicating knowledge is relevant to my empirical analysis. The implication of Carlile's arguments in this thesis is the need to understand how knowledge, especially the new knowledge related to the health extension packages and other health initiatives, is communicated across boundaries in the everyday practice of the HEWs and community volunteers. The perspective of "knowledge communication across boundaries" (Carlile, 2002; 2004) provides a framework to analyze the

different knowledge boundaries and communication processes among the public health actors, for example, between HEWs and their supervisors, and between HEWs and the rural households. The focus on knowledge boundaries and the properties of a boundary, i.e. differences, dependencies and novelty, is a way to describe the relation between the knowledge used in one practice and the knowledge used in another. I use the concepts of “transfer, translation and transformation” as defined by Carlile throughout this thesis.

Different researchers mentioned that knowledge brokering can contribute to innovation and knowledge communication (Hargadon, 2003; Howells, 2006) and it is effective in improving the quality in decision making (Dobbins et al., 2009). This study is concerned with the knowledge brokering role of community volunteers and HEWs in expanding the innovative health extension packages and other health initiatives. In analyzing the empirical materials of the study, this thesis has also employed the concept of knowledge broker that I now provide an overview.

3.2.3 Knowledge broker

Knowledge brokers can be understood as persons or organizations that facilitate the creation, sharing, and use of knowledge (Sverrisson, 2001). Knowledge brokers take part in at least the two practices for which they broke. The primary task of a knowledge broker is to connect knowledge seekers to sources of knowledge in a particular topic area (Dougherty, 1992). In this study, HEWs and community volunteers acted as knowledge brokers who connect knowledge seekers (the rural community) with sources of knowledge (the innovative health extension packages and other new health initiatives). Brokering involves the processes of knowledge transfer, translation, transformation and it promotes interaction (Ziam, 2010). The broker is constantly seeking knowledge opportunities in his/her immediate environment, capable of introducing promising new innovations (ibid). Brokering knowledge thus means far more than simply moving knowledge—it also means transforming knowledge (Myer, 2010). The role of knowledge brokers is even more important when the knowledge that is used is acquired from domains that have different languages and concepts (Ziam, Landry and Amare, 2009).

The role of knowledge brokers as intermediaries is widely documented. For instance, Pawlowski and Robey (2004) analyzed the role of the knowledge broker, as played by information technology (IT) professionals. The authors described that IT professionals were facilitating the flow of knowledge about both the IT and business practices across the

boundaries that separate work units within organizations. IT professionals facilitated knowledge sharing by connecting user organizations that were dealing with similar issues. The primary activity through which IT professionals became brokers was participation in user communities. By interacting with multiple communities, IT professionals were able to bridge traditional boundaries separating business units. Knowledge was also transferred from users to IT professionals since understanding the practices of IT users was seen as critical to IT work (ibid).

In the technology sector, brokers are seen as agents of change who have the capability to foster the adoption of new technologies and to support the decision making in their favor (Ziam, Landry and Amare, 2009). The dimension of intermediation is essentially based on the knowledge brokers' social network. They can develop and maintain relationships with individuals, groups and organizations (Hargadon and Sutton, 1997). Knowledge brokers sought to reduce uncertainty by explaining the relevance of knowledge acquired in one part of the organization to another. Knowledge brokers, therefore, contributed to knowledge transformation not only by transferring knowledge but also by aiding in the interpretation of that knowledge (Pawlowski and Robey, 2004).

Over time, this role of knowledge brokers has diversified and has often been adapted to different practices including the health sector (Lomas, 2007). In Australia, for example, brokering practices have been introduced with the establishment of new coordinating and monitoring units in the intensive care services, which aim to promote knowledge transformation in the intensive care network and ultimately improve the effectiveness of its services (Rolls et al., 2008). Leeds Institute of Health Sciences (2009) also indicated that individuals were employed to act as "knowledge brokers" and their job was to facilitate the transfer of knowledge between researchers and practitioners in order to improve health outcomes. Within the same vein, this thesis explores the knowledge brokering role of HEWs and community volunteers in communicating the community and scientific knowledge among the public health actors. Such knowledge bases both from the scientific and community sources need to be combined and communicated among the public health actors in order to bring the required progress in the health care provision and information systems in the context of a developing country, which I discuss next.

3.2.4 Combining scientific and community knowledge

Researchers showed that pragmatic differences across community and scientific knowledge may generate conflict of interests in attempting to combine the two knowledge domains. For example, with regard to soil classification and use, integrating the scientific and community knowledge have tended to be problematic; either because of the practical difficulties involved in trying to integrate farmers' cognitive soil maps with scientific soil maps held by a GIS, or because of the epistemological differences between the two traditions (Oudwater and Martin, 2003; Payton et al, 2003). Other writers also express some doubts about the apparently unproblematic 'union' of the two knowledge domains because the objectives and priorities of the two approaches are so divergent (Briggs, Pulford, Badri and Shaheen, 1998; Haburema and Steiner, 1997). For example, in regard to the soil type, the scientific knowledge tends to focus on the deeper soil horizons, representing the more fixed characteristics of soils; the community soil knowledge, on the other hand, tends to focus on the surface layers which are more relevant to agricultural evaluation.

In some cases, academics have considered community knowledge as primitive, simple and static and scientific researches may also attempt to discredit the local community knowledge in order to maintain their position and power. For example, the local environmental knowledge of the rural community in Ethiopia was discredited because they were held responsible for producing environmental degradation (Hoben, 1995). Consequently, all the other elements of the rural community knowledge base, such as fertilizer methods, the use of ash, the use of rotational leguminous crops, terracing methods, and locally constructed run-off ponds to collect rainwater were also, wholly undeservedly, discredited.

Nevertheless, other researchers also revealed the need of acknowledging the importance of community knowledge base for sustainable environmental development and acceptance of the scientific methods by the community (Rahman, 2000; Rengalakshmi, 2006; Puri, 2007). Thus, the two knowledge systems (from scientific and community sources) need to be bridged. In the context of land degradation, Puri, (2003) identified three domains of knowledge that are relevant and often in tension with each other and with the overall objective of land management, being technical, scientific and indigenous knowledge. Technical knowledge relates to GIS technology and remote sensing. Scientific knowledge concerns the application domain that drives from the scientific parameters relating to, for example, soil types, slope of the land, vegetation patterns and rainfall. While community knowledge relates to people's

understanding of local resources and practices around land use, for example, the kind of water harvesting structures that have historically existed in a local setting.

Puri (2003, 2007) argues that the local community knowledge of the environment can provide practice-specific understandings that can complement scientific knowledge. For instance, GIS technology can be used to prioritize areas for intervention based on the extent of land degradation defined through scientific parameters such as soil erosion and water tables. Hereafter, community knowledge can be drawn upon to provide the practice-specific inputs for developing interventions strategies in the identified areas, for example whether to build a new well or rejuvenate an existing water body. The author stresses the importance of constructing knowledge alliances between these technologists, scientist and the community in order to support more effective IS development and implementation. For instance, Puri (2007) explains that communities drew resource maps on the ground to depict the location of various existing resources, and the appropriate locations of the proposed interventions. The markings made by the community members on the ground maps were subsequently incorporated into the GIS database by the GIS scientists. The scientists acknowledged that the community had a keen sense of the local topography and drainage patterns, and were aware of traditional water-harvesting structures had been beneficially used in the past. The author showed how the knowledge originated from scientists; system developers and the community can be drawn upon and made work together in the process of GIS implementation.

Rengalakshmi (2006) also described that it was possible to establish a continuum between scientific and the community weather forecast, which combines the scale and period of the onset of rainfall. The scientific forecast provides a probability distribution for the amount of seasonal rainfall as well as specific quantitative forecasts for medium-range rainfall amounts. The seasonal rainfall forecast does not provide information on the likely onset of rainfall and its distribution. On the other hand, traditional forecast knowledge is able to help the farmers in terms of the possible onset of rainfall using such indicators as direction and intensity of the wind during summer season, position of the moon, and other supportive indicators. Although the reliability of the traditional indicators varies, they do help farmers prepare for the timing and distribution of rain, while a scientific forecast may help them prepare for the amount. The amount of rainfall and the timing of onset are the two most significant variables farmers use to make decisions on their initial agricultural activities. The different strengths of the two systems, when combined, provide farmers with more valuable information than either system can provide in isolation (*ibid*). It was also argued by Suchman (1994) that the objective

epistemology of scientific knowledge needs to be rearticulated to include multiple, located and partial perspectives to accommodate the lived experience of organizations.

Rahman, (2000) also emphasized the need of establishing an integrated community and scientific knowledge base to address a priority issue in terms of sustainable socio-economic development and poverty alleviation in developing country. The author found advocacy, social mobilization and program communication approaches useful for shared dialogue and partnership building for political leadership supports and the participation of local communities’.

According to McKee, 1992, as cited by Rahman, 2000;

Program communication is a process of identifying, segmenting and targeting specific groups or communities with particular strategies, messages or training programs through various mass media and interpersonal channels, traditional and non-traditional.

Advocacy consists of the organization of information into argument to be communicated through various interpersonal and media channels with a view to gaining political and social leaderships’ acceptance and preparing a society for a particular development program:

Social mobilization is a process of bringing together all feasible and practical intersectoral social allies to raise awareness of people and demand for a particular development program, to assist in the delivery of resources and services and to strengthen community participation:

Although early scientific researchers have mostly described indigenous knowledge with negative connotations, time has shown that some of the knowledge is worthwhile (Mercer et al, 2009). The indigenous postpartum maternal and child care in Nigeria, for example, helps a first time mother to receive parental and housekeeping practices from her mother. During a four-week period after birth, the postpartum mother is given a special diet which makes the uterus contract and thus helps in expelling of blood clots. The diet also helps to restore blood lost during childbirth, to restore energy thus facilitated the healing of wounds and restores normal bodily functions and promotes lactation. The health care programs need to consider such important practices based from the community knowledge and integrate them in their assistance strategies (Emery, 2000). There are also similar practices in Ethiopia in taking care of the post-partum mothers. Besides, there are historically constituted community-based indigenous institutions (such as Edir, Equb and Debo) that promote collective practice and solution provision on a voluntary basis. The purpose of these indigenous community-based organizations includes jointly addressing social and economic challenges (Mengesha, 2011).

Not all aspects of the indigenous knowledge and practices are beneficial. For example, there is much criticism of some community knowledge and practices, such as cutting the uvula of small children. However, by encouraging beneficial traditional practices, one is also able to challenge harmful ones (Brehony, 2000).

Generally, community knowledge is a very good source of readily available and already tested appropriate knowledge source for policy makers to use in their planning process. It is believed to be a very useful mechanism in providing a framework upon which technical and scientific questions are built (Dube and Musi, 2002). This thesis has also given some examples of the community knowledge and improvisations that helped the HEWs and community volunteers to accomplish their day-to-day activities and in shaping the standards to be implemented in their locality. Hence, the succeeding sub-section presents the topic of standardization and flexibility in relation to HIS which has a particular relevance for my study.

3.2.5 Standardization and Flexibility

Scientific knowledge operates in the health care sector, for example, in the form of guidelines and standards that govern the provision of health services, and data collection and reporting. Health workers are expected to implement these standards on the ground, and this could potentially lead to tensions between scientific and community knowledge. Therefore, it is relevant to discuss standardization and also flexibility. The concept of standardization with the required flexibility is used in this thesis to emphasize the significance of “standards” and “flexibility” for the public health service provision and information systems. This study focuses on how the health workers implement standards into their practices, such as working guidelines, rules, regulations, and the health service plans designed by the health authorities, with the required flexibility in their day-to-day practices. The issue of standardization and flexibility is thematized by different researchers (for example, Hanseth et al., 1996; Timmermans and Berg, 1997; Bowker and Star, 1999; Braa and Hedberg, 2002 and Braa et al. 2007). For example, Timmermans and Berg (1997) describe standards (standardized working guidelines) as intervening in a specified situation and prescribe a set of medical interventions, which should be performed in a similar way, to achieve results which are comparable over time and space. Nevertheless, those standing orders do not hold true in certain situations (ibid). The present study has identified the issue which is closely related to Timmermans and Berg (1997). However, this thesis emphasizes the crucial role of community knowledge to make the standards practicable.

Different authors have mentioned that standardization enables coordination, which in turn enables the exercise of control over distance (Law, 1986, Bowker and Star, 1999). Standardization aims for control by using standards that guarantee uniformity and predictability, and standards intend at making actions comparable over time and space. However, the uniformity comes at the expense of individuals or local autonomy (Timmermans and Leiter, 2000). Consequently there will be a tension between the global and local side of the solution, hence, a central problematic issue related to standardization is the tension between universality versus locality. Since conditions and needs are not similar in different practices, the standard must be flexible enough to be appropriated to varieties of work practices and locations. This global reach of the standard or its universality thus inevitably depends on local conditions, such as the existing infrastructural and material resources.

Different authors in various ways have expressed the need for such a balance. For example, Berg and Timmermans (1997) introduced the term “Local Universality”, which emphasizes that universality, always rests on real-time work, and emerges from localized processes of negotiations, and pre-existing institutional, infrastructural, and material relations. Hanseth et al. (1996) discuss two kinds of flexibility—use and change flexibility—and argue that standards need both. Change flexibility (the ability to change standards) is enabled by modularization and combining simple standards with gateways. Use flexibility determines the extent to which a standard can support many different activities and tasks. Use flexibility makes it possible for users to change practices supported by the standard without changing the standard. Braa and Hedberg (2002); Braa et al (2007) also introduced the principles of “hierarchy of standards”. It is quite evident that one cannot find one optimal solution (Bowker and Star, 1999), and that there will always be some costs related to establishing “universal” solutions. The application of standards, therefore, will inherently be in tension with the local realities in a given community raising the need to balance the flexibility and standardization.

a. Standardization and Flexibility in HIS

Scholars have demonstrated that information systems need to be adapted to the local practice. In the case of HIS, standards need to be in play so that data can be collected in uniform formats and time intervals and be compared across facilities and geographical regions. Comparisons are required to allocate scarce resources over various competing needs, and this can only be made possible through using of standards. Standardized work practices help to coordinate and compare the performance between districts, provinces and countries

(Mavimbe, 2007). Information systems have to be tailored according to the different requirements, for example depending on the hierarchical levels in the health care system (Braa and Hedberg, 2002; Braa et al, 2007). The authors stress addressing different information needs at different levels of the health administrative structure. A core principle is that only essential information for action should be collected at each level. At the national level a “Minimal Data Set” should be defined, and the other levels in the healthcare system hierarchy (such as provinces or districts), which will have additional information needs related to local actions, are free to add to this data set. The hierarchy of standards principle was described as the key ingredient to reach consensus during the standardization of health care data in South Africa (ibid). While analyzing the HIS of Ethiopia, Woldeyohannes and Molla, 2005 also stressed that ensuring data items are compatible across various data collecting instruments is a key component of the standardizing process.

In the case of developed country, the study conducted about electronic patient record (EPR) standardization in a Norwegian specialized hospital also showed that the reasons for failure for the system include overemphasizing criteria of universality, uniformity, and centralization of control to achieve alignment, stabilization, and closure (Hanseth et al, 2006). EPR systems are presumed to improve work processes through efficient information management, facilitate increased information sharing among professionals, and enhance communication between various healthcare providers. Although the implementation of the EPR aimed at reducing paper and eventually replacing the paper system, the paper based record remained an important tool. Paradoxically, the production of paper documents increased markedly after the implementation of the system. The authors emphasized the need of flexibility based on local requirements rather than over emphasizing on universal criteria.

b. The Role of Protocols as Standards

Different strategies and approaches to standardization are used in health care domain, such as standards, protocols and guidelines that actually affect the health care practices (Temmermans and Berg, 2003). For instance, standardization in the health care has been described as part of practice of attempting to coordinate work globally (Bowker and Star, 1999). Using of International Classification of Diseases (ICD), the World Health Organization (WHO) attempts to coordinate information about morbidity and mortality. The ICD is an old list centrally administered by the WHO, aimed at mapping diseases that threaten public health. It is used by general practitioners, hospitals, insurance companies, statisticians, governments, and others worldwide. It implements WHO’s efforts of categorizing causes of death for

statistical and clinical purposes. In practice, however, it has proven nearly impossible to fully standardize the ICD due to local work practices, cultural differences, and diverging requirements and interests (ibid).

Standardized guidelines in the form of “best practice” recommendations, clinical procedures, or research protocols are widespread in healthcare, where they are designed to reduce variations in practice and thus to enhance the quality of care in all locations (Komaroff 1982; Wennberg 1991). According to Berg (1997), protocols or guidelines are set of instructions telling to the implementer how to do the activities in specific situation. Timmermans and Berg (1997) revealed that protocols intervene in a specified situation and prescribe a set of medical interventions, which should be performed in a similar way, to achieve results which are comparable over time and space. These instructions may be designed as detailed flow-charts, or they may consist of a number of rather vague and general recommendations, but they are all designed to guide the person through a sequence of steps. Through their coordinating role, such standardized guidelines may create room for different new tasks, for example, through the usage of a protocol; oncological nurses were able to handle complex drugs with which they otherwise might not have been able to work (ibid).

However, since protocols set precise criteria, which are uniform for all settings: they may not fit with the realities in a given community. Thus the use of protocols may overlook significant aspects and lead to the loss of important information and interventions that are difficult to make explicit or to quantify (Berg 1997). Although oncological protocols allow nurses contact with new drugs, new possibilities for cure, with a wider varieties of patients and treatment plans, etc., not all these reasons guarantee that the protocols will be followed in minutest detail. In the case of Cardio Pulmonary Resuscitation (CPR), for instance, the protocol ordered that a paramedic and nurse always have to start and continue the resuscitative effort until an emergency physician arrives and decides to quit the life-saving attempt. However, those standing orders did not hold true in certain situations (Timmermans and Berg, 1997). Medical doctors also may go beyond the boundaries of medical protocols. For example, although the drug magnesium sulphate is not part of the protocol of the resuscitation procedure; it is sometimes given as a last resort to save the life of the patient. The protocols explicit written demands are tinkered with to make the protocol workable in practice. The authors argue, this tinkering of the protocol is not showing the limits of standardization in practice, rather it demonstrates the ongoing subordination and articulation of the protocol to meet the primary goal of the working procedure.

In his study of the immunization service in Mozambique, Mavimbe (2007) conceptualized the Expanded Program of Immunization (EPI) as an information infrastructure comprising of three socio-technical elements of the cold chain, knowledge and information systems. Standards are seen to provide the glue for the three sub-systems to work together. He mentioned that various standards need to be in play, for example to coordinate geographically dispersed units, compare activities over time and also across various activities of programs (for example, between EPI and Antenatal care). The author emphasized that standards are essential for the EPI to work but is neither the absolute measure nor a guarantee that they will be used uniformly across or even within immunization practices. Making standards work depends on various interconnected materials.

In the case of immunization program, as mentioned by Mavimbe et al (2006), a set of uniform guidelines and protocols (the “cook book”) were created by WHO and implemented by the training of health workers. The health authorities tried to make these translated standards accessible and usable by the health workers who were responsible to provide vaccination services in the remote areas of Mozambique. According to the authors, this guideline seeks to maintain uniformity while performing immunization, and data gathering, aggregation and reporting in the information systems. However, subjectivities among health workers cannot be eliminated.

Protocols are ubiquitous in clinical research, but are also important for public health-oriented information systems. For instance Shrestha and Bodart (2000) recommend that standardized protocols and operational definitions need to be developed in order to improve the data quality. A study conducted on the Ethiopian HIS also showed that absence of standardized instructions and guidelines was one reason for incorrectly filled data in the forms (Mengistu, 2005). This thesis also emphasized that standardized protocols or working guidelines are important whereas flexibility is required, based on the community knowledge and other local realities, while using those working guidelines.

While the merits of standardization with flexibility, such as for effective design and implementation of HIS is discussed by different researchers, the role of community knowledge to fit the standards on the ground is far less understood, especially in the context of a developing country and community-based settings. This thesis builds on the perspective of flexible standards, and complements it by emphasizing the impact of community knowledge in relation to standardization and flexibility.

3.3 Summary-Analytical Framework of the Study

This section consolidates the theoretical framework for this thesis. Based on the reviewed literature, I have developed an integrated perspective (See Figure 3.2.) to explain the conceptual linkages.

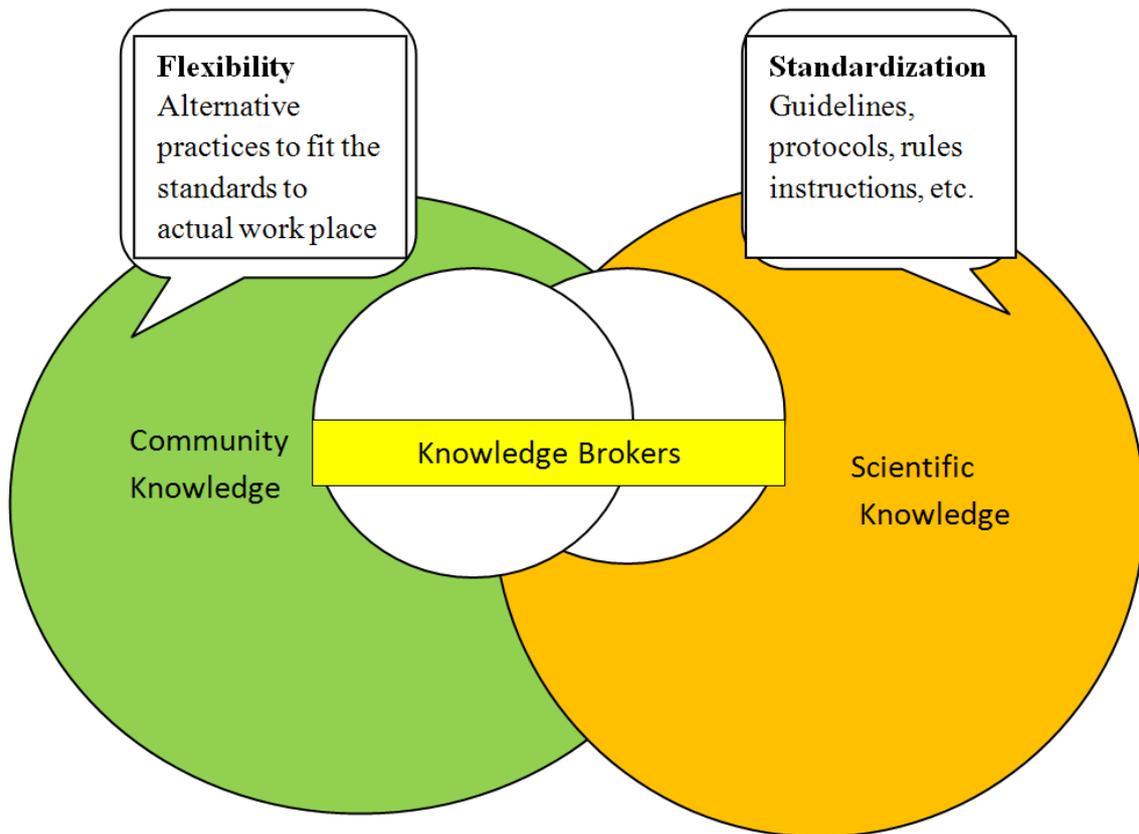


Figure 3.2: Illustration of the knowledge brokering role of HEWs and community volunteers within the community and scientific knowledge domains.

This thesis illustrates the potential of community knowledge in the practices of HEWs and community volunteers that include shaping the standardized guidelines developed by the health authorities to make it workable in their local context. As portrayed by Figure 3.2 above, both the scientific and community knowledge are important for the public health sector in a developing country. The two knowledge systems are overlapping, and need to complement each other. In this thesis, HEWs considered as having better scientific knowledge than the community volunteers. Since HEWs have completed a tenth grade formal education and they are trained for a year in public health, as well as, they take many other on the job trainings, and the vice versa holds true for the case of community knowledge, since community volunteers are members of a given community. This study examined the role of

HEWs and community volunteers as knowledge brokers, who facilitate knowledge communication in the public health sector in Ethiopia.

According to Reij, Scoones and Toulmin (1996), the knowledge and practices of a particular community are inevitably mediated by external influences from “outsiders”, such as extension workers and businessmen. In this case, the HEWs in Ethiopia, who mostly know the culture and practices of their communities and have scientific knowledge about health from their pre-service and on-the-job trainings, can act as a mediator (knowledge broker) to produce a composite knowledge. Community volunteers also facilitate brokering, via their close communication with neighbors and friends. The advocacy, social mobilization and program communication approaches that help to establish an integrated community and scientific knowledge base (Rahman, 2000) were found useful to describe the shared dialogue, partnership building and knowledge brokering in day-to-day practices of HEWs.

This study follows practice based perspectives since this tradition is not focusing on cognitive aspects and the tendency to make knowledge an entity by rather emphasizing how knowing is related to doing (Nicolini et al., 200; Carlile, 2002; 2004). This approach helped to understand everyday practices of actors participating in the community based health services.

In summary, this thesis has discussed the different conceptual ideas that influence my understanding of the use and communication of community and scientific knowledge in the public health sector of Ethiopia. Together, these concepts help to understand the role of community knowledge in the health service provision and HIS implementation of a developing country. As the focus of the study was the community based health service provision and HIS, it provided me opportunities to explore how health workers use the community knowledge, for example, when offering the health care services to individuals and households. In a practice-based research approach, it is crucial to be able to observe what people do, what their work is like, and what effort it takes to solve problems (Carlile, 2002). The following chapter provides the research strategies and methods used to carry out this research.

Chapter Four: Research Methodology

This chapter describes the research design and methods adopted in this thesis. The chapter starts with the origin of the research by providing background of the researcher to enable the reader to get more insight into the motivation of this research. It continues by providing the reasons for using qualitative research methods and interpretative philosophical assumptions. Details of selection of the research sites, the processes of data collection and analysis technique are then described. This is followed by the ethical consideration and some personal reflections. The chapter ends by presenting a chapter summary.

4.1 Origin of the Research

The researcher has been working at the family health department of Amhara RHB, Ethiopia since 2006. This department was responsible for maternal and child health, and the health extension program. Accordingly, I have been involved in various activities related to the health extension program. This exposure inspired my interest in the phenomena, and subsequently helped me in defining the research problem of the present study.

I conducted my master thesis on the HIS of Ethiopia (see Damtew, 2005) and the findings highlighted poor data quality and poor information use for action. Based on the study findings and the community health service initiatives in Ethiopia, I was motivated to expand my study and decided to understand how the community knowledge is used in strengthening the health service provision and HIS. In addition, I had the chance to see the HIS of all zones of the Amhara region, Ethiopia, during my field visit with two colleagues prior to commencing my PhD project. This broad exposure also helped me to develop a deeper understanding of the problem domain. The academic environment of the University of Oslo encouraged me to develop the research proposal and I had an opportunity to enroll in a PhD program in 2008.

The social science perspective to public health and information systems studies adopted for my masters and in this thesis has nurtured through reading of various literatures, and discussions with colleagues and advisors. This perspective emphasizes that the study subject could not be understood independently of the people around it, their social relationships and the work practices that they are engaged in within their everyday lives (Walsham, 1993). I felt this approach was relevant in this research, since it enabled exploration of the social and cultural aspects related to using the community knowledge in a public health organization of a developing country entrenched in mounting the community based health service.

4.2 Research Approach and Design

According to Myers (1997), all research is based on some underlying assumptions about what is valid research and what methods are appropriate for undertaking that research. The nature of the research problem and the expectations from that research all influence the philosophical stance taken and the choice of suitable techniques for data collection and analysis. This study has adopted qualitative methods, since the research purpose was exploring the use and communication of community knowledge in public health organization in a developing country that calls for a study which is detailed and qualitative. Qualitative research explores the richness, depth and complexity of a phenomenon. Hence, qualitative researchers study things in their natural settings, attempting to make sense of or interpret phenomenon in terms of meanings people bring to them (Denzin and Lincoln, 2000). Creswell (2003:181) describes the process of qualitative approach as follow:

“Qualitative research takes place in a natural setting. The qualitative researcher often goes to the site (home, office) of the participant to conduct the research. This enables the researcher to develop a level of detail about the individual or place and to be highly involved in actual experiences of the participants.”

My approach has focused on understanding the issue of community knowledge in context, and how this knowledge domain is used by the health sector to improve the HIS and health services provided to the public. This study mainly deals with the community level health service provision and information systems. This process requires repeated follow up over time in order to gain such knowledge and understanding, rather than a one-shot event through survey. This was done using qualitative methods which enables one to follow events and their consequences within a context (Miles and Huberman, 1994).

The present study takes an interpretative epistemology and emphasizes an understanding of the social world through an examination of the interpretation of that world by its participants. A non-positivist (interpretative approach) starts out with the assumption that access to reality is only through social constructions, such as language, consciousness and shared meanings (Myers and Avison, 2002). Positivist studies attempt to test theory or hypotheses based on the ontological assumption that reality is objectively given and can be described by observable properties, which are independent of the researcher and his or her instruments. In contrast to the positivist approaches, interpretive researchers assume that scientific knowledge should be obtained not through hypothetic-deductive reasoning but through the understanding of human and social interaction by which the subjective meaning of the reality is constructed (Walsham,

1995). Subjective reality emphasizes that the same situation might be interpreted differently depending on who provides the account of it (Walsham, 1993), based on their backgrounds including culture, education and experiences. In other words, interpretive research does not predefine dependent and independent variables, but emphasizes the complexity of human sense making as the situation emerges (Kaplan and Maxwell, 1994). The researcher's role as an interpretivist is on attempting the difficult task of accessing their people's interpretations, filtering them through their conceptual apparatus, and feeding the version of events to the informants (Walsham, 1995). Table 4.1, summarizes the difference between interpretive and positivist approaches.

Table 4-1: Distinction between Positivist and interpretive approaches

	Interpretative	Positivist
Ontology	Empirical world is subjective, exists only through human social action.	Empirical world is objective, independent of humans
Epistemology	Social reality can only be interpreted, aimed at understanding meaning; Analytical generalization.	Theory is temporarily true until it become falsified and replaced by another theory; Statistical generalization.
Research methods and techniques	Field (case) study, interviews, observation, document reviews, discussion...	Sample survey Laboratory experiments...
Modes of analysis	Describe, interpret and understand the social world from participant's perspective	Inferential statistics
Role of researcher	Never assume a value-neutral stance; Always implicated in the phenomena under study.	Impartial observer, Can comment on means, Cannot comment on ends, Position of value-neutral.

Adapted from Orlikowski and Baroudi (1991),

This research was conducted over a period of four years divided into six time periods: January to February 2008, September to December 2008; July to August 2009; December 2009 to February 2010; March to May 2011; and November to December 2011. The research approach is based on the principles of case study. A case-study, when associated with a qualitative approach, is a pertinent strategy for researchers to explore in-depth a program or individual(s) using a variety of data collection procedures over a sustained period of time (Creswell, 2003). Klein and Myer (1999) also stated that qualitative case study is characterized by researchers spending extended time on site, personally in contact with the activities and operation of the case, reflecting and revising descriptions and meanings of what is going on. The case study is

a useful approach to adopt when the phenomenon of study is difficult to disengage from its context (Miles and Huberman, 1994), for example in studying the community based health activities in rural villages of Ethiopia.

4.3 Study area

Selection of the Research sites

The research was conducted at the public health organization of Ethiopia, mainly at the community level. As mentioned in Chapter two, this organization has introduced community health services through the health extension program. The national health system is composed of different hierarchy starting from the health facilities, to districts, zones, regions and FMOH. The HEWs, on whom this research is more focused, are supported by staff from different levels in the health system hierarchy and other partners, mainly by their supervisors from the health facilities and district health offices. Relevant information for this study has been sought from different levels in the health care system and the HEWs training schools.

The Amhara region was selected for the study. It is one of the nine regions and two city administrations constituting the Federal Democratic Republic of Ethiopia. The region has 10 zones and three city administrations, which is sub divided into 167 *weredas* (districts) of which are 38 town administrations and 129 rural *woredas*. The total population of the region is around 20 million, which accounts for about 23% of the total population of the country. Out of this, nearly 87% of the population resides in a rural setting engaged mainly in agricultural activities. Amhara region was selected for this study for two basic reasons. First, the health extension program in the region was expanded earlier. Currently, nearly 99% of the rural *kebele's* in the region are covered with HEWs (Amhara RHB report, 2011). Second, the investigator was working at different levels in the health care system in the region. The previous familiarity of the institutional setting helped to establish rapport with health workers and health managers. Besides, being a resident of the Amhara region, it was easier and less expensive for me to conduct my research there that minimized the transport and other expenses. Different researchers have mentioned the shortcomings of undertaking research in one's own home environment, such as researcher bias and nervousness of the study participants to explain their experience fully (Hockey, 1993; Dwyer and Buckle, 2009). Considering my prior knowledge of Amhara region and my closeness to its health bureau staff, I have attempted to minimize such shortcomings as described in subsection 4.7 under the title personal reflections.

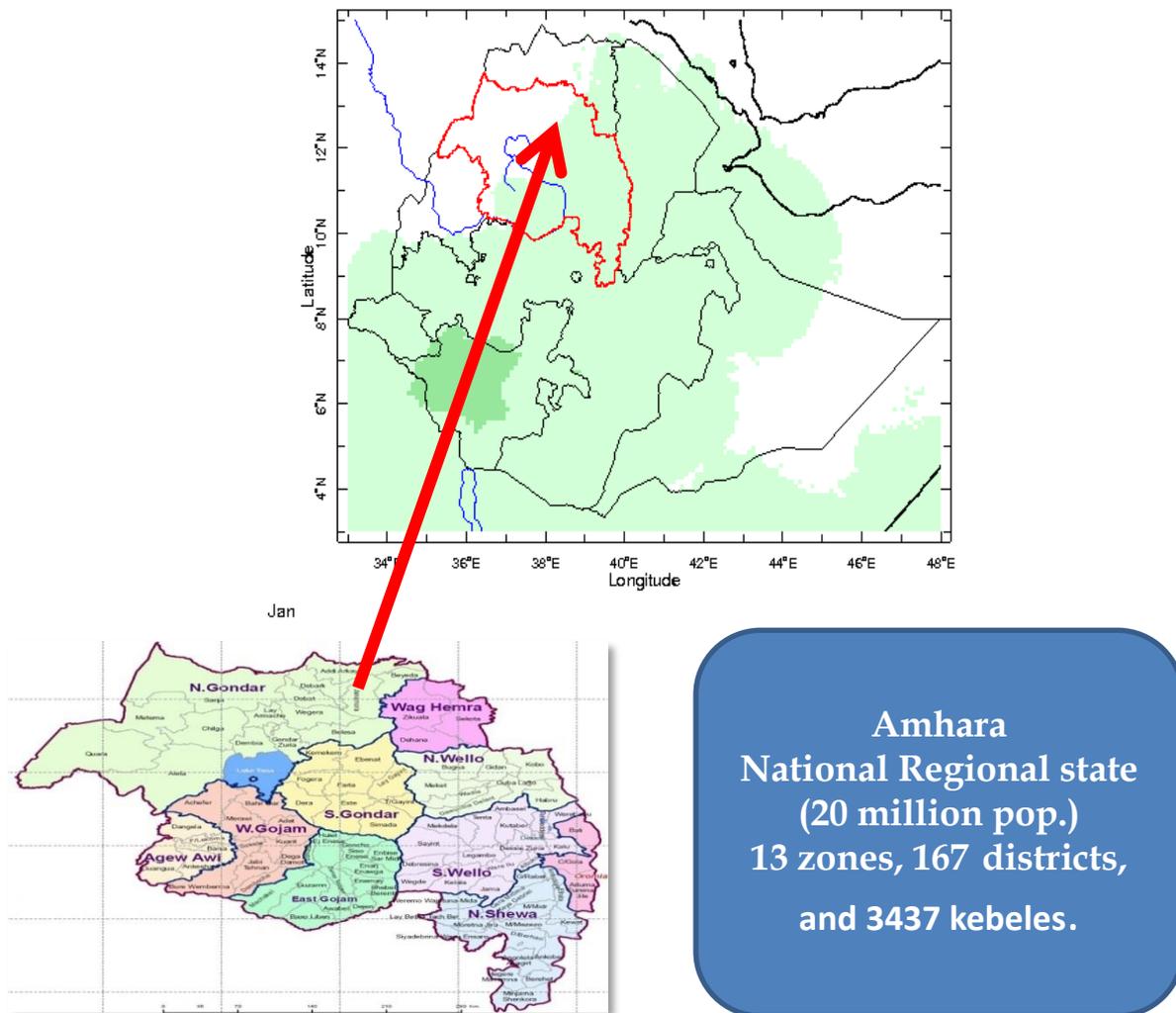


Figure 4.1: Map of the Amhara region

Six districts in the three zones of Amhara region, namely Bahirdar Special, Mirab Gojjam and Awi zones were included in this study. Eighteen health posts and five health centers within the selected six districts were visited. The rationale for selecting these three zones drew upon that Bahirdar is the capital city of the region, which may represent the urban areas and the others are rural ones. Besides, Awi zone is one of the three ethnic zones in Amhara region. This strategy allowed the researcher to see patterns of events, such as, related to the residence of HEWs and working style. Although all HEWs are expected to reside in the communities they serve, some HEWs from all the three zones live in the nearby district towns which may create some gaps with their social interaction and knowledge communication with the community.

This study was multilevel in that data gathering was carried out at the national, regional, zonal, district, and community levels, with more focus on the health extension program (community level). The premise of this study is to understand how community knowledge can

be used and communicated amongst public health actors. The following diagram indicates how health data are communicated.

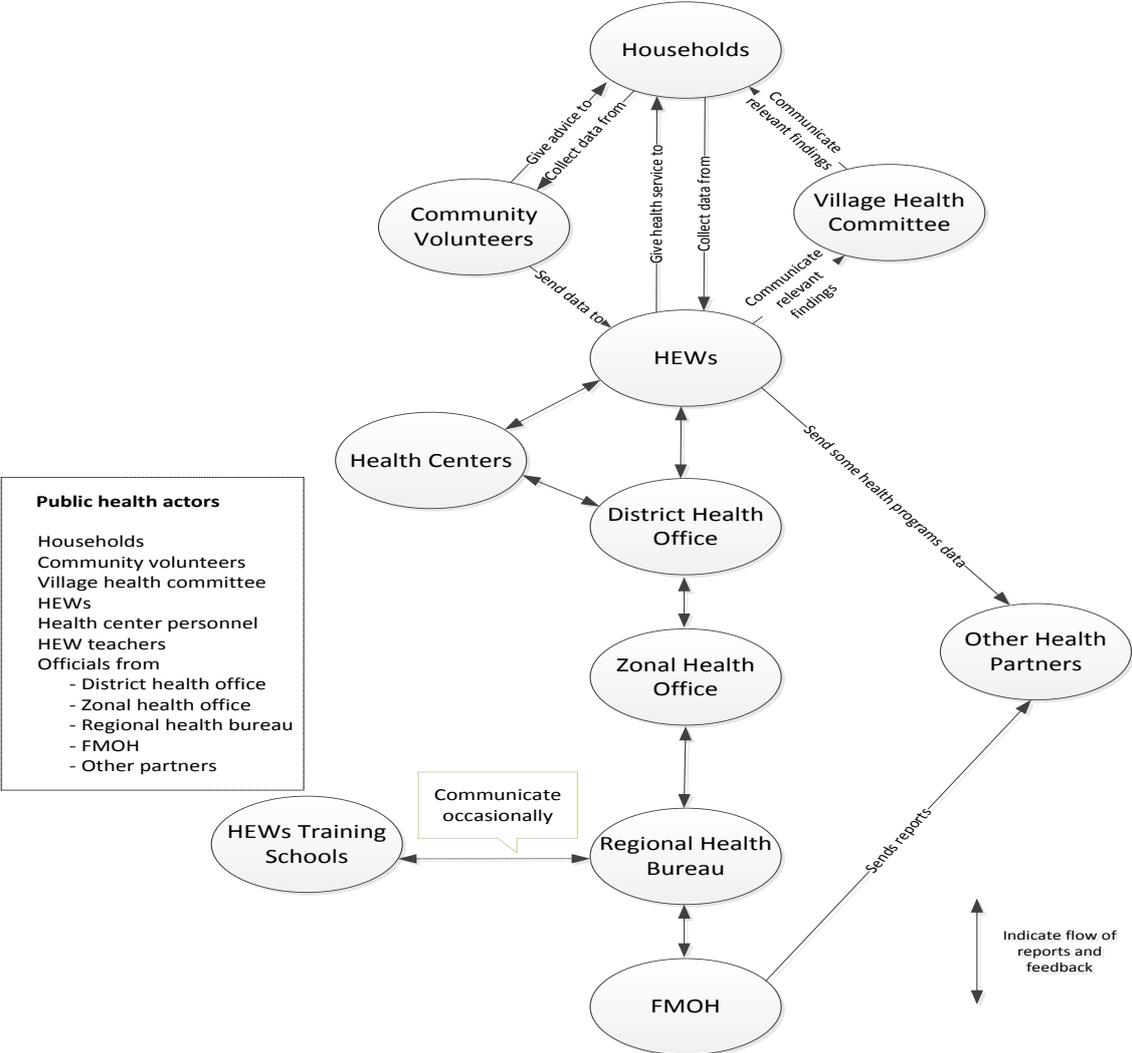


Figure 4.2: Public health actors included in this study

Figure 4.2, indicates the public health actors and their relationships. Community volunteers and HEWs offer health services and collect health data from the households. HEWs compile reports and submit to the nearby health center, district health office, and they also send some health programs data to other partners. Then the report and feedback flow based on the health system hierarchy from the district to zones, then to RHBs and FMOH. Other partners also get the required reports from the health sector. Meetings held at different levels, such as, between the health center and respective health posts staffs, and discuss monthly performances. HEWs also communicate relevant findings, for example, about epidemics, with the village health committee in order to find joint solutions. HEWs act as the focal point who interact both with the community and the health sector that emphasizes their role as knowledge brokers.

The empirical materials for this study drew upon qualitative methods of data collection that aim to study people in their natural context by observing, talking and reading what they have written (Sliver, 2005). This approach was required to gain insight from different perspectives into issues of the newly initiated health extension program and how to communicate and use community knowledge in the health sector. The subsequent subsection provides detail of the data collection methods used in this study.

4.4 Data Collection Techniques

Qualitative data, as Silverman (2005) has argued, helps to map inner experiences, language, culture, and forms of social interactions to develop deep contextual understanding of a phenomenon. This method 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). Given the nature of my in-depth and continuous involvement in the field, I have been engaged in collecting various forms of qualitative data through multiple mechanisms. More specifically, data collection methods used in the study included semi-structured interviews, participant observation, meetings, and secondary data collection through reviewed documents including of forms, manuals, strategic plan documents and health status reports. The use of different data collection methods helps to decrease the investigator bias, increase validity, and strengthen the interpretative potential of the study (Denzin, 1970). Yin (1994) also argues that the use of multiple sources of evidence in case-studies allows an investigator to address a broader range of historical, attitudinal and behavioral issues. Thus any finding or conclusion in a case-study is likely to be much more convincing and accurate if it is based on several different sources of information.

Silverman (2005) stated that to suppose that any researcher enters a field without past experience or any pre-existing ideas is unrealistic. In such a context, the researcher acts as a participant observer and is involved in various activities. Having a public health background and courses in HIS, I have been trying to be involved in different activities, for example, as a trainer of the health managers, as a supervisor in health campaign events, and a participant in discussions of health workers meetings. My involvement in the domain allowed me to get a unique access to the processes and rich contextual exposure. This approach helped me to capture context sensitive data; for example relating to the knowledge communication patterns among the public health actors. Since each facility was observed more than once, it helped to observe ongoing changes, for example associated with the commencement of treating killer diseases at the health posts and the registers that comprise an outline of how to treat those

diseases. This was followed by joint discussion with HEWs in order to refine the researchers' understanding and to develop more coherent explanations. The findings showed HEWs appreciated the curative service since it increases their acceptance by the community.

Part of the fieldwork was carried out along with one of my research advisors from the University of Oslo, while other field trips were undertaken independently. During joint fieldwork, individual interpretations of notes taken during the data collection were separately prepared and subsequently discussed. These summaries were also apprised to the interviewees to cross-check what they said as recorded and interpreted by us, or to seek further clarification. Similar procedure was adopted while undertaking fieldwork independently. I now discuss the detail of each of the data collection techniques used.

Interviews

Creswell (2003) describes interviewing as one of the most common and most powerful ways to understand human being since it gives room to both the interviewer and interviewee to clarify opinions and view through interactions. Walsham (1995) also has argued that the primary source of evidence in the context of conducting interpretive case study research is in-depth interviews; since it is through this method that the researcher can best access the interpretations that participants have regarding the actions and events which have or are taking place. Interviews, for instance, are an important way to understand people, particularly the meanings they bring to bear on the places they live and work (Zussman, 2004). Interviews, on the other hand, can be used to clarify information that is not understood through other data collection methods.

In the present study, I interviewed officials and health managers from different level in the health care hierarchy of Ethiopia; health workers, HEWs, HEW teachers and officials at HEW training schools. The largest group of interviewees was HEWs since the focus of this study was to understand the role of community knowledge for strengthening HIS and PHC provision. As such, some key informants were interviewed more than once. The interviews were typically in-depth, lasting between half to one hour and semi-structured interview guides were developed. In addition, several informal conversations and discussions took place. Relevant excerpts from transcribed material were selected and included in this thesis in order to emphasize key themes during the writing process.

The interviews were conducted in Amharic (the official language in Ethiopia), and in some cases I translated the conversations to English because of the presence of my advisor, who could not understand the local language. For some respondents who were able to

communicate in English, for instance, health managers at the regional level and HEW teachers, interviews were conducted in English. However, when I collected data independently, I preferred to conduct interviews in Amharic so that respondents felt more comfortable to express their feelings and ideas properly with their local language. Interviews were not tape recorded in order to avoid unnecessary apprehension of the informants; however, detailed notes were taken. In addition, through continuous interaction, I could ask for further clarifications on issues that I had not understood. The interviews were then translated into English for analysis shortly after the interview session or at least in the same day.

Mostly, the interviews were conducted at the work places of the respondents. I visited health offices in the health care hierarchy, and a number of health posts and centers which served as the first point of contact of the community. These contacts helped to gain a better understanding of the communication practices amongst the health staff, and the health workers with the community. For example, during my field visit to the health posts, I observed anxious patients looking for treatment, albeit there was no medication handled by the HEWs at health posts. In these health posts, I also got an opportunity to discuss with the community volunteers (called vCHWs – voluntary community health workers) to understand their interactions with HEWs and the community.

I used semi structured interview guides and interview questions were different according to the informants' job responsibility. The interviewee guide was changed throughout the data collection process, as new concepts and perspectives emerged from the data. Health workers at the facility level were asked questions related to their day-to-day practices. The way they communicate with their peers, the higher levels in the hierarchy, community volunteers and the community, problems they encountered in doing their tasks and the ways they solved them were discussed. The HEWs, who are the key informants of this study, have very tight work schedules, and they do most of their activities through home visiting. As such it was needed to make an arrangement through their mobile telephone before the day of the interview. Sometimes, I interviewed the two HEWs in the same health post together. However, if one of them had left for home visiting, the one who was available was interviewed. Health workers at the health centers, mostly who are responsible to compile reports were interviewed. At the district, zonal and regional levels, most of the informants were health managers who are responsible for the health extension program. At the national level, the informants were experts at the HIS section. At the level of health managers, questions were aimed at

understanding how they handled the problems encountered to the HIS; for example the target setting procedure to the health services, how they considered the local information and knowledge from the health workers and the community, and how these inputs can be integrated to the countries effort of the HIS reform. HEW teachers and officials in HEW training schools were also asked about the teaching learning processes and the problems encountered. Table 4.2 presents a summary of respondents in relation to their work place and their job responsibilities.

Table 4-2: Respondents work place, job responsibility and number of interviews

Organizational level	Respondents Job Responsibility	Number of respondents	Total number of interviews conducted (With Repetition)
FMOH	HIS experts	3	4
Amhara RHB	Department head	2	2
	Health extension program coordinators	3	5
	Immunization program Expert	1	1
Zonal Health Department	Head of the Zonal Health department	2	3
	Health extension program coordinator	3	5
	Other health managers	2	3
District Health Office	Head of the District Health Office	5	7
	Team leader	6	8
	Health Extension workers supervisors	8	11
Health Facility	Nurses and Health officers	8	10
	Health extension workers	22	35
	others	3	3
HEW training schools	HEW Teachers	12	15
	Responsible person	4	6
	Total	84	118

Participatory Observation

Observations can lead to deeper understandings, because they provide knowledge of the practice and context in which events occur, and they enable the researcher to see things that participants sometimes themselves are not aware of, or that they may be unwilling to discuss. Observations are also important to be able to ask relevant questions as well as to get a better understanding of how the thing being studied functions and being used in practice (Walsham,

1995). Observation can take place in two different forms: the researcher can act as an external observer by simply observing different activities with little interference; or act as a participant observer aiming at becoming a full participant in the activities studied (ibid). For practical reasons, I became a participant observer since I got involved in different activities, for example, as a trainer and supervisor in the health campaign events.

As a participant observer, I had contact with the health staff at health facilities in order to have a depth understanding of various issues surrounding their day-to-day practices. Informal talks and discussions have been taken place during the observation sessions. My observations involved working practices of health workers related to both health service provision and data collection, compiling and reporting, and their interactions with each other and their clients. At the health facilities, for example, I observed how health workers capture data and the forms and registers they use to collect and report data of different health activities. This helped me to gain an understanding of the presence of multiple registers at the health posts that require modification, which added more work load on HEWs. I was also involved in the child health survival campaign events in Amhara region that helped me to understand the efforts of HEWs and community volunteers to overcome the challenges encountered through their community knowledge and improvisations. Such exposures helped to deepen my understanding of the realities at the ground related to the health service provision and HIS in resource constrained settings, and the significance of community knowledge to fit the standards to actual set up. Notes of observations were taken throughout. I noticed that observing can be a powerful tool to get insights into various aspects. Using this method allowed me to gain a better perceptive into the local workplace setting and the work practice.

During visits to villages and health facilities, I have taken multiple photographs of different events such as the health campaign events, the communication between health workers and the community, hand drawn maps and health indicators produced by HEWs and posted on the walls of the health posts, etc. These too have helped to make more vivid the context in which the research has been carried out. A few examples of those pictures are shown below.



Figure 4.3: Photos taken during Field visits

Another data source used in this thesis was participating in meetings. Meetings are organized at different levels in the health care system hierarchy of Ethiopia, monthly, quarterly and annually aimed at evaluating the health service performances, discussing challenges encountered and making plans. I have participated in numerous relevant meetings, discussions, and presentations with health staff at regional, district and facility levels. These meetings and discussions served various purposes, such as to understand lots of issues related to, for example, the health service planning, and other concerns raised by the participants, and to discuss with the officials of issues I saw during my field visit. For example, at the RHB meetings, I was able to discuss the improvisations done by HEWs and the ways of multiplying such beneficial practices. Participating in meetings helped to gain different kinds of insights, from the health workers side, for example, about the challenges they faced in their day-to-day practices, and from the health managers side, for example on the nature of decision making in the government. During the meetings, I took notes and documented statements from participants about the issues raised related to the community health service and HIS.

Document Review

Document analysis was also used in this study. Study of the secondary data provided insights into the efforts made by the governments on the health extension program implementation and HIS reform process in the country. The secondary data sources were also helpful in understanding the efforts of the regional, zonal and district administrations, and other stakeholders to improve the existing HIS and health service provision. Various documents were collected and reviewed to understand the health plans, work routines, rules and procedures. The documents analyzed included; the national health policy, the health sector development plan III (HSDP III), health planning and performance reports, the health extension program profile in Ethiopia, HIS reform strategic documents, data collection and reporting tools, working guidelines for health workers and the HEWs training school curriculum. These documents were reviewed in order to gain information on the government's plan for the health extension program, and HIS, including the initiation of the HIS reform in Ethiopia. Such documents were useful to learn about major events, decisions made by the government, key actors in the health system and their roles. Besides, it gave me background information to conduct the interviews and to explore in further detail particular responses during the interviews.

Organizational documents are in most cases not transparent representations of organizational routines and decision making processes. Besides, the documents may not depict the organization's existing situations because the organizations evolve over time and the documents become outdated (Ellis et al, 2003). Thus, there is a need to relate what we read from the organizational documents with other data sources (Sliverman, 2005). Yin (1994:81) also stated that;

“The most important use of document analysis is to corroborate and augment evidences from other sources.”

In line with this, analyzing of the available documents allowed me to substantiate the findings obtained by other data collection methods.

4.5 Data Analysis

This study takes an interpretative epistemology which seeks to understand the social world through an examination of the interpretation of that world by its participants (Walsham 1993, 1995). Interpretative approach adopts the position that “realities as well as our knowledge thereof are social products and hence incapable of being understood independent of the social

actors that construct and make sense of that reality” (Orlikowski and Baround, 1991, p13). In view of that, the current study takes the position that reality could be constantly constructed by both the researcher and the participants rather than assuming the phenomena are separate from those involved in giving meaning to those phenomena.

Different authors have emphasized that the analysis of qualitative data is a continuous process that starts in the research field during the data collection process. For instance, Myers and Avison (2002) pointed out, in doing qualitative research; there is no clear distinction between the gathering and analysis of data; since “the analysis affects the data and the data affects the analysis significantly” (p9). Silver (2005) also revealed it is better to expand field notes and begin analysis as soon as possible after each field visit. 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 (Seidel, 1998).

Following the above authors, my analysis began in the research field during the data collection process. I attempted to transcribe the data as much as I could of what was said during interviews and observations. As such, the transcripts were first prepared and summaries of interviews in some cases were cross-checked with respondents. The transcripts were subsequently analyzed and this time extracting sections in which data were organized. At the data collection stage, the focus was on grasping general ideas from the transcripts and giving each idea a particular name, instead of detailed coding. In this manner, different ideas in interview transcripts were identified and named before going on the next transcript of the same case. During joint fieldwork with my advisor, individual interpretations of notes taken during the data collection were separately prepared and subsequently discussed together. Silver (2005: 169) stated “where there is more than one researcher, sorting out what you are seeing and hearing is never just about collating data: it is data analysis”.

During the analysis, going back to the data for clarification was needed on a number of occasions. I had field notes and transcripts which gave me limitless opportunities to return to my original data and redefine the categories as the analysis progressed. As the result of iterative data collection and analysis, the research questions were changed throughout the research process to reflect the emergent findings. For instance, although the initial purpose of this study was related to data quality, based on the empirical findings, I then focused on the implications of community knowledge in the health care provision and information systems in developing countries. For example, in the first paper of my thesis, the community health workers knowledge was described as follows;

Community health workers acquire information and knowledge about their catchment populations, the common diseases and cultural practices that influence health actions. This local knowledge is mostly used to inform their practices (Paper I).

Subsequently, my second paper showed the conflicts arise from the mismatch between the official population data used for health service planning and the number of target population known by the HEWs and community volunteers. For example, the following quotes from HEWs were interpreted to reflect a contradiction arising from the inflated health service plan given from the district authorities to health facilities, and the respective population known by the HEWs and community volunteers;

'We have tried our best level to reach all available targets by enumerating house to house, however, the district health office staff evaluated us based on their target, and we scored very low grade. It is very annoying for us'.

'We don't bother about the district target, because we know that we are right' (Paper 2)

I interpreted the first quote that HEWs were forced to follow the plan designed officially by their superiors rather than the number of target population in their locality known by themselves. Such a practice was a challenge for them. The second quote, on the other hand, emphasizes that HEWs rely on their community knowledge rather than the target given by the district authorities. Both of these pieces of “evidence” led to the interpretation of the challenges of using community knowledge in the process of data capturing, analysis and health service provision.

Starting from my basic quest around the topic of community knowledge, I have attempted to develop richer insights around the role of community knowledge in the health service provision and information systems. For example, in one of the case studies of this research, an empirical finding concerned the role of community knowledge to fit the standards on the ground was analyzed.

In this research, the literature was used as a guide for data collection, and to analyze and make connections with the empirical findings from the field. According to Klein and Myers (1999), theories are used as sensitizing devices to approach a phenomenon in a certain way. Silverman, (2005:9) also reveals that theory provides a framework for theoretical understanding of a phenomenon and a basis for considering how what is unknown might be organized. “Data analysis and reading are mutually informing.” For instance, reading of Puri, (2003, 2007) and Rengalakshmi, 2006, work on the significance of the community

knowledge to prevent land degradation in India provided a substantive knowledge about the value of community knowledge. Similarly, Senanayake, (2006) indicated the value of community knowledge in education system and he suggested that the academics, policy makers, and planners should pay greater attention to this invaluable treasure of knowledge. My focus in interpreting the empirical data is to understand how the community knowledge impact the HIS and health service provision in a developing country. To analyze this phenomena, I also used the perspectives from (Puri, 2003; 2007; Rengalakshmi, 2006; ICSU; 2000, Kanjo, 2012) about harmonizing knowledge systems from scientific and community bases in order to develop a more effective strategy and sustainable development in developing countries.

Towards the end of my research, the material from Carlile helped me to construct how knowledge can be communicated in the public health sector of Ethiopia. An inverted triangle introduced by Carlile (2002, 2004) that shows the increasing complexity of knowledge boundaries and knowledge communication in new product development allowed me to analyze the processes and challenges faced while implementing new health initiatives. This perspective provided me a means to differentiate the knowledge boundaries and communication among the public health actors. This approach also provided an insight to identify the knowledge barriers that may help to develop the required strategies. I also used other concepts, such as knowledge broker, standardization and flexibility, which helped to complement my analysis. For example, the standardization and flexibility concepts allowed emphasizing the role of community knowledge to shape the standards in the actual practice. In general, various concepts and theoretical perspectives were employed throughout this study as initial guide for data collection, as part of an iterative process of data collection and analysis, and as a final product of the research (Walsham, 1995).

As such individual interpretations drawn from the analysis of empirical data collected during fieldwork were discussed with the health staff, health managers, my research advisors and colleagues. These formal and informal discussions helped to develop coherence in my interpretation, and in writing various versions of documents and refining them. Feedback received from them allowed me to further revise and enrich the analysis. This approach helped in the development of the first versions of my papers, which were further developed on receipt of comments from reviewers in journal reviewing processes or the audience in seminars. The collaboration with my research advisors and my colleagues from South Africa

and Malawi in the paper writing process (Paper I) provided me an insight on the role of the community knowledge in the HIS implementation in other contexts.

These above examples illustrate how the analysis proceeded in a reflexive process with inputs coming from various sources including readings of the literature, reviewers' comments, presentation in international and local seminars, and informal conversations with my colleagues and advisors. My early analysis of findings has been very much focused in identifying the role of community knowledge in the HIS implementation and health service provision, the challenges encountered in HEWs day-to-day practices and the ways to overcome those challenges. In latter stages, the emphasis was in exploring context sensitive strategies based on the community knowledge and improvisations, and how those practices and lessons learnt can be communicated amongst the public health actors that may in turn benefit the existing HIS and health service provision to the public.

4.6 Ethical Considerations

A letter of ethical clearance was obtained from different places. Primarily, the research proposal was cleared by the PhD Board of the Faculty of Mathematics and Natural Science at University of Oslo. Then permission letters were written from the University of Oslo and submitted to the FMOH and Amhara RHB. Hereafter, cascade of consent letters from relevant authorities were obtained to all observed institutions. All study participants were informed about the study and confidentiality was maintained. The data collections in this study were conducted with the consent and cooperation of informants and relevant health authorities.

4.7 Personal Reflections

Knowing that the health care setting of Ethiopia and various practical issues related to HIS are familiar for me, I carried out this study as an involved researcher. I had the richest possibilities of discussing the issues related to the HIS, community knowledge, target setting, etc. with health workers and health managers. I had opportunities to obtain more information with the clarification questions by conducting additional interviews and doing observations. Bonner and Tolhurst (2002) identified three key advantages of being an insider-researcher: one, having a greater understanding of the culture being studied; two not altering the flow of social interaction unnaturally; and three having an established intimacy which promotes both the telling and the judging of truth. Further, insider-researchers generally know the politics of the institution, not only the formal hierarchy but also how it "really works". They know how

to best approach people and they have a great deal of knowledge, which takes an outsider a long time to acquire (Smyth and Holian, 2008).

However, Dwyer and Buckle (2009) mentioned that although the insider role of the researcher can be beneficial to get rapid and more complete acceptance by the study participants, it has also the potential to impede the research process. The authors revealed that it is possible so as the participants will be nervous or make assumptions of similarity and therefore fail to explain their individual experience fully. They also mentioned home blindness or the researcher's personal experience that may affect the data collected. Unconsciously making wrong assumptions about the research process based on the researcher's prior knowledge can be considered a bias (DeLyser, 2001).

In this case, I have tried to minimize such bias by communicating with the study participants in a friendly manner to avoid unnecessary anxiety, and through discussing the aim of the study with health managers at different levels and health workers. Reading of various literatures prior to the data collection helped me to shape the interview guide based on the purpose of the study. The interview guide was open ended that elicited views and opinions from the respondents rather than simply responding to the closed ended questions. This approach created opportunities for more probing that took place when more questions were generated during interviews. I collected data from multiple sources; in the different levels in the Ethiopian health care hierarchy and HEWs training schools. Besides, I did the preliminary fieldwork and other two field visits with my research advisor from the University of Oslo. The directions given from my advisor during the joint fieldwork helped me to identify the focus on the theme of the study. Discussions made at the end of the days of joint data collection also helped me to reshape the interview guide for subsequent data collection. My collaboration in data analysis and paper writing with other researchers from Malawi, South Africa and outside Africa; herein some knew similar problems in other contexts, also made contribution.

4.8 Summary of the Methods Section

In summary, in this chapter, I have presented details of my research methods, including the research origin, study area, research design, data collection techniques, analysis, ethical consideration, and personal reflections. Accordingly, I have explained my motivation to conduct this study. I also described the epistemological assumptions for different approaches and the reason for my choice of the interpretative research. It was argued that I chose to

collect data using qualitative data collection methods because they allowed me to capture detailed and context sensitive data. The role of theoretical concepts in the process of data collection and analysis was also described. Finally, the pros and cons of being an inside researcher were elaborated. The articles in the appendices explain the details of the methods used in relation to particular papers.

After presenting this overall description of the research approach, I now present the summary of the research findings in chapter V.

Chapter Five: Findings

The aim of this chapter is to discuss the findings of the research papers included in this thesis. The following five papers are included in this thesis;

1. Damtew, Z., Kanjo, C., Kaasbøll, J., Williamson, L., *Using and Sharing Locally Generated Information for Action: The Case from Three Developing countries*. Published in the proceedings of the Iadis International Conference information systems, March, 2010. Porto, Portugal. PP. 85-93
2. Damtew, Z., Kaasbøll, J., *Target Setting procedures for Immunization Services in Ethiopia: Discrepancies between Plans and Reality*. Journal of Health Management. 13(1) 2011, pp.39-58.
3. Damtew, Z., Moges, A. Kaasbøll, J. *Revisiting the Quality of Health Extension Workers Trainings: - Case Study from Amhara region, Ethiopia*. Ethiopian Journal of Health Development. 25 (3) 2011, pp.201-205.
4. Damtew, Z., Aanestad, M. *Benefits of Local Knowledge in Shaping Standards:-A Case Study from Community Health Service and Information Systems in Ethiopia*. Scandinavian Journal Information Systems. 24 (2) 2012, pp. 27-50.
5. Damtew, Z., *Accelerating Health Service and Data Capturing through Community Health Workers in Rural Ethiopia: - A Pre-requisite to Progress*. Published in the proceedings of the International Conference on Knowledge Management and Information Sharing, October 2012. Barcelona, Spain, pp. 168-177.

I now present a brief summary of each of the included papers, and the synthesis of how those findings answer the research questions posed by the thesis.

5.1 Summary of papers

5.1.1 Paper 1: Using and Sharing Locally Generated Information for action: The Case from Three Developing Countries

Damtew Zufan, Kanjo Chipso, Kaasbøll Jens and Williamson Louisa, (Published at the proceedings of the IADIS International Conference, 2010)

This paper draws on case studies conducted in three developing countries of Africa, i.e. Ethiopia, Malawi and South Africa. Although each case was conducted independently, the commonalities in the practices of community health workers and their use of locally generated information and knowledge prompted the comparison. For instance, the rural settings of most developing countries, including in the three countries being compared, do not have street names and house numbers. The locality of an individual is known by virtue of knowing the individual or having an idea where people answering to that name come from within the locality. In each case, the health management cadres studied; the HEWs in Ethiopia, clinical managers in South Africa and officers in charge in Malawi, were those closest to the communities. Our study compares and contrasts how these community health workers operate i.e. their actions, practices and how they handle and use the locally generated information for the benefit of the system. The study describes the commonalities and differences in the three contexts.

Drawing on concepts from knowledge literature and an interpretive approach, this study illustrates the importance of locally generated information and knowledge in the three contexts. The findings from the three countries show that the community health workers and their assistants interact, observe the practices within their communities, and build on the knowledge for that community. As they conduct door to door visits within their locality, community health workers collect health data (on a daily basis) from the households. They also record vital statistics (deaths, births and other population variables) and other incidences in the community such as; disease outbreaks, and selected medical supplies, such as contraceptives and insecticides treated nets supplied to communities. Hence, they acquire information and knowledge about their catchment populations, and the common diseases and cultural practices that influence health actions directly or indirectly. Although there were differences in terms of limitations (such as uneven distribution of community health workers and work overloads); largely the ways the community health workers in all three countries operated were comparable. Their actions and practices, such as how they handle information, how they use locally acquired knowledge for the benefit of the system, and how they interacted with higher levels were similar.

This study indicated community health workers knew their catchment areas and the people living there. This implies knowing different villages, communities, households or even patients in their clinics. This context-specific knowledge is mostly used to inform their practices. They use this knowledge to recognize the coverage of different health services,

absentees' retrieval, and drawing maps which they used as a guide when conducting home visits to their clients. For instance, the case of South Africa showed that a community health worker had a map of her area, showing where all the tuberculosis patients were living, so that the staff could go and get them if they did not show up for treatment. Similarly, HEWs in Ethiopia use the hand drawn maps as a guide for their daily activities, for instance to plan their household visits and offer the required service. This knowledge was gained not only through collecting health data, but also because of their living within the communities that they serve.

Due to the introduction of community health workers in most developing countries, the local population knowledge is now updated continuously, while a census is normally held each decennium. Our study shows that the population data, at least at the village level, can be shifted from the semi-permanent to the frequently updated dataset. Thus, our study challenges the assumptions that emphasize the design of HIS has been based on the idea that health data and health service data are provided from the health facilities (Sauerborn and Lippeveld, 2000; Braa and Blobel, 2003). However, the semi-permanent data like population figures and facility names are given from the central administration (ibid). This study suggests that the information generated by these community health workers also need to be considered in the semi-permanent data.

Hence, this paper emphasizes a notion of knowledge alliances between the community and scientific sources. Hence, scientific ventures need to focus on empowering and motivating people to participate on crucial issues, such as for their own health, in order to take advantage of the wealth of context-specific knowledge held by the local communities.

5.1.2 Paper 2: Target Setting Procedures for Immunization Services in Ethiopia: Discrepancies between Plans and Reality.

Zufan Abera Damtew and Jens Kaasbøll, (Health Management Journal, 2011)

The empirical basis for this study is derived from a case study conducted on the target setting procedure for immunisation in Ethiopia. The health care system of Ethiopia has institutional rule for target setting and planning. Conversely, HEWs know the population in their catchment areas and counted children below the age of one year, who are eligible for immunization. This paper analyzes the two types of target setting processes for immunisation; i.e. the target is given to health facilities by district authorities using the census data, and the number of eligible children known by HEWs and community volunteers.

The study shows the quandary that occurs due to disparity of the target that is designed in a top-down manner from the projected population of old census data and the number of population known by HEWs. Although the target of immunisation was set by the RHB staff and persons responsible for each district, they followed the population data projected from census and the value set by the FMOH for each service strictly. The target for immunisation was taken from the population data projected from the census (thirteen years before the study time). Moreover, planning was done based on national intended coverage (goal) for all districts uniformly. It did not consider the performance of the previous year or other locality specific criteria. This shows that the district health office staffs had no mandate to make any change on the targets of their own area; rather they were forced to accept the target calculated from the projected population and the value set by the FMOH. Ultimately, the district health offices distributed the targets for the health posts and health centres, which were under their supervision.

The findings showed that staffs from the health facilities have to follow the plan formulated according to the rules of their organisation, which was based on high population figures in most cases. Hence, despite their tremendous effort to provide immunisation for every child, their achievement was regarded as lower when their performance was calculated against the inflated denominator. For example, HEWs from one rural health post reported that their previous year achievement for BCG immunisation was only 54 percent when calculated against the target given from the district authorities. However, had it been calculated from the number of children below one year of age counted by themselves, it would have been 92 percent. HEWs mentioned the difficulty of achieving the goal (90 percent coverage) for all immunizations because of the inflated targets and they did not accept the population data and targets set for immunisation and other health services in their sub-districts. They collected baseline data during their deployment and updated the figures continuously for their respective sub-districts. Besides, they believed that they had plenty opportunities to know the number of children of their catchment area, as they rendered most of the health services house-to-house. In addition, community volunteers provided them with all the required information. Thus, the study found that most HEWs considered that the inflated targets given from the projected census lowers their achievements, since their performance should be calculated against the given target. This in turn affected the incentives given and had negative implications for job satisfaction and performance.

Taking the perspective of institutional theory as an analytical tool, this research indicated that the existing planning mechanism for immunisation service of Ethiopia suffers from a lack of alignment between targets given from the census data and the number of eligible children known by HEWs and community volunteers. The study showed how institutional rules formulated within the health care system formally, face informal constraints from the health staff. This paper analyzed the views of HEWs and health managers on the existing target setting mechanism, and how they dealt with the ambiguity. The problem associated with the targets was understood at every level in the health care system. Alongwith health workers, health managers from district health offices, zonal health departments and RHBalso did not disagree with this issue. However, as the planning scheme is a regulation and working procedure formulated by the governing body, they couldn't make any change.

This paper recommended the need for considering the reality on the ground, rather than following only the formal institutional rules in order to address the identified impediments. District health offices, who closely supervise the activities of HEWs, need to find options to incorporate local information inputs for planning rather than relying only on census data. For instance, locally generated information can be used to disaggregate census data below the level of districts.

5.1.3 Paper 3: Revisiting the Quality of Health Extension Workers' Training: Case- study from Amhara Region, Ethiopia.

Zufan Abera Damtew, Amsalu Shiferaw Moges, Jens Kaasbøll, (EJHD, 2011)

This study examined the quality of HEWs training in Ethiopia. The HEWs had to complete a one-year course in health after completion of the general education up to the tenth grade. The training takes place at Technical Vocational, Education and Training Institutions, which also run many other training programs, whereas the trainees were recruited and also deployed to their work places by the health sector.

The findings indicated that the curriculum for the training has incorporated courses that were crucial for the work of HEWs; however it was not practically possible to cover all the topics included in the course syllabus in the given time frame. Although the curriculum prescribed 70 percent of the training time for practical sessions and 30 percent for the theory, teachers opted to teach theoretical lessons instead of practicum. Besides, the quality of HEWs training was affected by a scarcity of teaching facilities such as classrooms and demonstration materials, such as medical equipment and standardized data collection tools. For example, an

interviewed teacher mentioned that he was not able to show the trainees how to record and report the required data since there were no standardized register and report form in the demonstration rooms. The medium of education is English, and most reading materials in the library were also in English which was difficult for HEW trainees to understand the subject matter easily. Hence, the language barrier, as well as, shortage of well- equipped health facilities nearby for the practical sessions was also mentioned as constraints.

The findings of this study also revealed that teachers did not get the required on-the-job trainings and sufficient responses for their inquiries, neither from the health bureau nor from the Technical Vocational, Education and Training Institutions. Besides, they were not clear about their benefits and future career that resulted in high attrition. There were no clearly defined roles and responsibilities between the health sector and Technical Vocational, Education and Training Institutions in relation to managing the HEWs training program. This created problems specifically related to teachers' incentives, on-the-job trainings and career development.

The study suggested the need of collaborative efforts of Technical Vocational, Education and Training Institutions, the health sector and other stakeholders to solve the problems encountered on the HEWs training program. The curriculum needs to be revised considering the topics included in the course syllabus in relation to the time given. Very few trainees would be able to transform what they learn in schools to their work, if they mostly have theoretical classes at school. Hence, practical sessions with actual cases and experienced health workers are essential for the trainees to develop their skills. This demands well-equipped demonstration rooms and practices with actual cases. The study also recommended remedying the problems associated with on-the-job training and future career of teachers in order to motivate them to work for a long time.

5.1.4 Paper 4: Benefits of Local Knowledge in Shaping standards:-A Case Study from Community Health Service and Information Systems in Ethiopia.

ZufanAbera Damtew and MargunnAanestad, (SJIS, 2012)

This study draws on empirical data from a qualitative case study of health data gathering and service provision during a child survival intervention campaign conducted in Ethiopia. The Enhanced Outreach Strategy (EOS) campaign is particularly well suited for the study, because professional health workers work alongside HEWs and community volunteers, and form the

team that implement the EOS. The campaign created situations where health workers are in a different and more involved relation with the local community than in the context of routine data collection in health facilities.

Standardized guidelines in the form of best practice recommendations, clinical procedures, or research protocols are widespread in healthcare, where they are designed to reduce variations in practice and thus to enhance the quality of care in all locations (Komaroff 1982; Wennberg 1991). Guidelines contain a set of instructions telling the implementer how to perform the activities in specific situations. This knowledge, inscribed into the health programs' standardized guidelines, in practice meshes with the context-specific knowledge of community health workers and community members. Thus the common practice of centrally defined programs, standards and guidelines sometimes goes against the insights from development studies that emphasizes involving the local community is crucial for effectiveness of implementation and sustainability (Piotti et al 2006; Puri 2003, 2007). This study conceptualizes the EOS guidelines as standards that direct the working procedures of health workers during the EOS campaign, with the aim of standardizing both the service delivery and data collection procedures.

The study focuses on how the standardized guidelines need to be flexible if context-specific knowledge of the community is to be incorporated. It examines how the community knowledge impacts adherence to the standard guidelines, with a special attention towards "productive deviation" from the guidelines. The findings showed that the EOS teams were following the guideline (the standard) strictly with respect to some aspects, and deviated on others. In line with their distinction between changeable and non-changing elements of the EOS guideline, the study suggested to introduce an analytic distinction between fixed and flexible elements of a standard. And the findings indicated that both the fixed (non-changing) and flexible elements of the standard were important for improved health service provision and data collection during the campaign. The EOS teams followed some instructions in the EOS guidelines strictly since changing them could compromise the aim of the campaign. For instance, the EOS teams followed guidelines' specification of the age group of children that should receive the service, and also they followed the guidelines with respect to the dose of ingredients given to each child. However, they also sometimes deviated from the guidelines and implemented alternative practices based on their context-specific knowledge and the context. These changes were introduced because the EOS teams perceived that they could have a positive effect on both service provision and data quality, without compromising the

aims. In some cases, the research showed that health workers and community volunteers were following different ways of doing rather than strictly following the guideline. For instance, when parents did not know the exact age of their children, the EOS teams tried to estimate or infer the age of a child by using community rituals, rather than using the calendar method. The alternative procedures, which were employed by these peripheral level health workers, were functionally equivalent with what is written in the EOS guidelines, but seen as more suited to the context.

This study identified the criteria that distinguishes the fixed from the flexible component of the standard, relates to the distinction between means and ends. The means (the procedures and actions to achieve the ends) were considered flexible enough to be changed, while the ends (the program's aims to offer the required services to children) were not considered flexible or changeable. The EOS team members knew the EOS program's aims well enough to not compromise them since they took the required pre-campaign training, and they also knew the context. Their supervisors followed them throughout and trusted the alternative ways of doing.

It is argued that the acceptable deviations depending on the community knowledge could however also be incorporated into the standard itself, that is the EOS guideline in this case. In order to design well-working standard, productive deviations from the standard should be observed, assessed and shared across the communities who have similar working conditions. A careful study of the local implementation of the standard and specifically how community knowledge is drawn upon and how specific constraints are dealt with by the EOS teams is considered important for re-designing the standard to suit the domain better. The health authorities need to consider revising the EOS guidelines by incorporating the input of grass root implementers (EOS teams), which may solve some problems, as well as, it can increase the opportunity of experience sharing across communities. For instance, creating a name based register to document the service given during the EOS campaign, instead of the anonymous tally sheets helped the health workers to retrieve absentees and thus to reach more children, as well as, it was also beneficial for improving the quality of data. These practices can be incorporated in the EOS guidelines. This study showed that the guidelines helped the EOS implementers in health service provision and data collection. Thus it is also important to develop standardized working guidelines that guide health workers in data collection and compilation for the routine HIS, in order to improve the data quality.

In sum, this study emphasized the crucial role of context-specific knowledge of HEWs and community volunteers to reshape the standards to be suitable in a given set up. There is of practical relevance to study how the community health workers and members of communities can be more involved for the health service provision and data collection. These practices were beneficial not only for the quality of data from the campaign itself, but also for the future service provision, and could also be used to improve data quality of the routine HIS.

5.1.5 Paper 5: Accelerating Health Service and Data Capturing through Community Health Workers in Rural Ethiopia: -A Prerequisite to Progress.

Zufan Abera Damtew, (Published at the proceedings of Knowledge Management and Information Sharing Conference, 2012)

This paper has addressed processes of communicating knowledge related to the health extension packages and the community health data, across syntactic, semantic and pragmatic boundaries among public health actors in the context of a developing country. The study identified different ways of knowledge sharing mechanisms. HEWs work closely with community volunteers, who help them in collecting the required information in their respective vicinities. HEWs offer formal and informal trainings for community volunteers and they do have monthly meetings, as well as, informal gatherings, which were found to be good media for knowledge sharing. Besides, some HEWs collaborate with TBAs thereby share experience and learn skills related to managing normal delivery from the TBAs. However, some TBAs were found not accomplished and interested to establish close contact with HEWs, and the lack of refresher training was mentioned as a major reason.

HEWs meet with the nearest health center staff monthly and with their district supervisors regularly. Some HEWs and their district supervisors made effort to find local solution for problems, such as, to resolve the ambiguity created by the discrepancy between the official target (given from the district authorities to health facilities) and head counted population. Although they couldn't change the planning scheme, some of them tried to find local solutions. For example, they follow the notion such as "There should be no unvaccinated infant, no household without pit latrine, and so forth." than being overwhelmed by the inflated targets given by the district authorities. Through the supportive supervisions, HEWs and their supervisors made dialogues thereby created shared meanings related to their work. HEWs also sometimes meet with the staffs at different levels in the health care system and share experiences.

HEWs mainly accomplish their activities through house to house visits that allow them to communicate with the households closely. They provide health advices and demonstrate to the family how to follow healthy practices depending on the health extension packages. Some households accept the health advice and guidance promptly and some may follow their neighbors and implement the required health action, albeit some households may resist changing. This requires continuous interaction to transform the current knowledge of the households, hence HEWs keep on motivating, demonstrating and negotiating with the household thereby to help them to practice health actions and enjoy healthy lives. Community volunteers also play an intermediary role; offer health information to their friends and neighbors.

While conducting home visit, HEWs hold some essential equipment and supplies including their ordinary exercise book which they call “field note-book” and take detailed notes. They give health services then record in the field note-book the services they provided, appointment date and health actions to be performed for the next visit. Afterwards, during the following visit, they check whether households have performed the health extension packages based on their advice. HEWs used their field-note for two purposes; for following-up of the implementation of health extension packages by households and to copy the data captured in the field to the main registers for reporting. The main registers are kept at the health posts and serve for data recording and preparation of monthly and quarterly reports. HEWs gather and compile the community health data continuously. They prepare wall charts with key health targets and indicators, and post them on the walls of the health posts. They usually use the data to monitor the progress of their services and one can easily look at the profile of their catchment areas at health posts. However, there were no standardized registers thus the data collected across health posts were not consistent and there was redundancy of data elements. HEWs, even within the same district, used different types of formats for reporting that sometimes affecting comparison of health facilities performances and constraining experience sharing.

Taking the concept of knowledge boundary and knowledge communication by Carlile, the study identified that knowledge communication of HEWs with their teachers, supervisors, peers, community volunteers, TBAs, and the community that needed different processes. For instance, at their pre-service trainings, the main media of instruction was lectures. It was mainly one way of transferring information from sender to receiver, as to Carlile (2004) that fosters knowledge transfer. However, lack of the common syntax between teachers and

HEWs due to shortage of teaching facilities and language barriers affected effective knowledge transfer processes. At the semantic level, HEWs discuss and converse with community volunteers and supervisors in order to create common understanding, relating to the performance reports.

The huge difference of HEWs and rural households in their knowledge domain and the need of their joint input for the implementation of health extension program creates pragmatic boundary that requires knowledge transformation. The findings of this study showed that the rural households may have their own knowledge and ways of doing to keep their family health, for instance they may follow some traditional healing practices. HEWs take pre-service and in-service trainings that equip them with knowledge and essence of the health extension packages. Hence, HEWs and households are specialized in different knowledge domains and they have many dependencies in completing a task. The dependencies between HEWs and households happen from the need of their joint inputs to implement the health extension packages. This required continuous negotiation, and the exemplary role of community volunteers to implement the innovative health extension packages and to bring the requisite progress in health actions of the rural dwellers. As (Carlile, 2004: 2002) puts it, communicating knowledge between people with different knowledge domains and high dependency faces a pragmatic boundary that requires close interaction and negotiating of conflicting interests. HEWs repeatedly converse, negotiate and renegotiate with households to allow them to transform their current knowledge and practice the innovative health extension packages. Meanwhile, the undertaking of HEWs to advance knowledge communication across the pragmatic boundary was intensified by the efforts of community volunteers. Both HEWs and community volunteers can take the role of knowledge brokers who are facilitating the communication and use of knowledge regarding the health extension packages. They facilitate knowledge communication and use between the source of knowledge (health extension packages) and potential users (rural households).

In their day-to-day practices, the two HEWs assigned in the same health post interact with each other thereby share knowledge. They bring new concepts and knowledge from in-service trainings, and they converse with each other and negotiate to create syntactic, semantic and pragmatic understanding among themselves.

The study identified knowledge communication barriers across syntactic, semantic and pragmatic boundaries that preclude knowledge transfer, translation and transformation. For instance, shortage of resources and the language barriers have affected the knowledge transfer

process at HEWs pre-service trainings. Absence of standardized data collection and reporting forms have also imposed challenges on sharing and multiplication of good experiences during meetings. The collaboration and social network were also hindered by lack of confidence and interest as seen by absence of communication between HEWs and some TBAs, which can be lessened through refresher trainings. The study recommended remedying of the identified impediments to make the context more conducive for knowledge sharing.

Table 5-1: Synthesis of Research findings

<i>Research Questions</i>	<i>Article</i>	<i>Findings</i>
<i>How can the community knowledge be used in the process of health service provision and HIS implementation in developing countries?</i>	Article I	<p>HEWs and community volunteers interact, and observe the practices within their communities; they also build on the knowledge for that community and utilize their context-specific knowledge for the benefit of the system.</p> <p>Therefore, there is a need of integrating knowledge from the community and scientific sources in order to enable the combination of community knowledge and the scientific one for health service provision and HIS implementation.</p> <p>The data captured and reported by these peripheral level health workers need to be used by the health authorities for different purposes.</p> <p>Hence, the designs of HIS need to consider the local input originated from the community knowledge.</p>
	Article II	<p>There is quandary related to the plan of health services due to disparity between the official target projected from the census and the population figure known by HEWs and community volunteers.</p> <p>There is a need to find options to incorporate local information input for planning rather than relying only on census data. For instance, locally generated population data by the community health workers and community volunteers can be used to disaggregate census data below the level of districts.</p>

	Article IV	<p>Centrally defined programs, standards and guidelines that guide health workers in health service provision and data gathering require incorporating local inputs generated from knowledge of peripheral level health workers and the community.</p> <p>The health authorities need to consider incorporating the beneficial practices of community health workers while revising the working guidelines, and data collection and reporting tools</p>
<p><i>How can knowledge communication among the public health actors be enhanced and contribute to improve health service provision and the routine HIS?</i></p>	Article III	<p>The curriculum for the training of HEWs has incorporated both practical and theoretical sessions; however the time given for the theoretical sessions was not sufficient and teachers opted to teach theoretical lessons instead of practicum.</p> <p>There is a need of revising the curriculum and adjusting the topics in the course syllabus to the time frame. Hence trainees get enough time for practical sessions with actual cases and experienced health workers that allow them to share knowledge and experience.</p> <p>Motivating experienced teachers is important, so as they can work longer and share their knowledge and experience to trainees.</p> <p>Demonstration rooms at HEWs training schools should be equipped with medical equipment and standardized data collection and reporting tools, so as HEW trainees will practice how to capture data and prepare reports before they begin their actual work.</p>
	Article IV	<p>Some working procedures related to health service provision and data collection, which are practiced by the HEWs and community volunteers, are</p>

		<p>beneficial. Thus, it is important to share such useful practices among the public health actors.</p> <p>Health workers sometimes deviate from the guideline developed centrally and implement alternative practices based on their community knowledge and the materials they have at hand that could have a positive effect on both service provision and data quality.</p> <p>Such productive deviation from the standard should be observed, assessed and shared across boundaries in the public health sector, hence can be beneficial for those who have similar working conditions.</p>
	Article V	<p>HEWs regularly meet with community volunteers, their colleagues and supervisors, and discuss their performance reports thereby share experiences and knowledge.</p> <p>They made efforts to find local solution for problems encountered. These practices need to be shared and multiplied; hence knowledge communication barriers, such as the obsolete target, absence of unified data collection tools and other resources need to be resolved.</p> <p>HEWs mostly do their works through house to house visits, where they interact closely with members of households. Community volunteers assist them in different aspects. TBAs are also good human resources in a country where majority of mothers give birth at home. Hence, there is a need to offer trainings for community volunteers, including TBAs in order to develop their capacity and boost their morale that may enhance their collaboration and knowledge sharing with HEWs.</p>

5.2 Understanding the role of community knowledge in the health service provision and HIS implementation of a Developing Country:-Linkage between papers

The papers included in this thesis were written based on the field work carried out and the theoretical framework considered to be suitable to understand the empirical work. This subsection is intended to present the linkage between papers.

This study initially analyzed the case of using local information and community knowledge for action in the three developing countries (Paper I). This paper constitutes the situation analysis done during my prior field work. The findings showed the similarity of using local information and knowledge by the community health workers in all the three contexts. There were evidences showing that the community health workers collaborate with the community volunteers, and they tend to know their population. This implies knowing the different villages, communities, households and their practices that affect health directly or indirectly. The findings of this study initiated the need for further analysis on the implication of this context-specific knowledge for the HIS implementation and other factors surrounding it, such as target setting procedures for health services, data capturing and reporting. The need for a detailed analysis on the nature of community knowledge, and how this knowledge is communicated across boundaries in the public health sector of a developing country enhanced further studies. This paper was the inspiration for the whole thesis.

Hereafter, to better understand the population issue in relation to what is known by the community health workers versus the official data used for the health service planning, an example of the target setting procedure for immunization service in Ethiopia (Paper II) was studied. The findings of this study found a mismatch between the number of eligible children for immunization known by HEWs and the target figure projected from census. These two different targets represent different knowledge paradigms, one based on knowing the community and door to door counting, and the other on projections from census data using scientific methods. HEWs and community volunteers claimed that they know the target population in their villages; and they have tried to immunize all eligible children by tracing defaulters, explaining the importance of childhood immunizations for parents, and pushing them to complete their children's immunization. Most parents got this information and recognized the importance of vaccines to prevent some childhood illnesses, hence showed up at immunization posts with their eligible children on the appointment dates. Despite all these efforts, the findings (Paper II) showed that the calculated coverage for immunization in most

visited villages was low because the performances of each health facility was calculated using the inflated target projected from census as denominator.

The target figures are very important to measure the success of a given health program, for example to calculate the coverage of fully immunized children in the expanded program for immunization (EPI). This is an important indicator that helps to measure the achievement of the EPI, which is designed to minimize the mortality and morbidity of children from vaccine preventable diseases in order to fulfill MDG4. Besides, indicators allow comparisons across facilities, districts and regions that facilitate sharing of experiences and knowledge. Targets are set to show the intended level of accomplishment of a given health program (Heywood and Rohde, 2000). In general, population figures are important for changing crude data into indicators so as to take the required action, which is the main purpose of the HIS. However, the findings of this study revealed that the discrepancy between the two targets (from knowing the community and head counting, and census data) for immunization service created confusion that needed remedy.

In this thesis, the perspective of how knowledge of the community health workers is generated, utilized, shared, and the impact it has on the community health service and HIS implementation is the main concern. It is known that the pre-service training is vital for trainees' skill development thereby entering and succeeding in their work (Finch and Crunkilton, 1999). Accordingly, Paper III investigates the potential factors that may affect the quality of HEWs pre-service training. This paper describes and analyses some of the factors that affect the learning-teaching process, which in turn may impact the skill development of HEW trainees in relation to health service provision, data capturing and reporting. The study identified constraints that negatively affect the knowledge communication between teachers and HEW trainees. A proposed solution includes revisiting the old curriculum that overloaded HEW trainees with theoretical sessions and offered less time for practicum, and mitigate the resource constraints in the training schools.

Paper IV elaborates on how the HEWs and community volunteers strive to implement the standards on the ground depending on their context-specific knowledge. This study draws on studies that thematize the tension between the universal nature of standards or protocols and the inevitable need for adaptation and flexibility when they are implemented in a given concrete context. The findings emphasized the need of standards with the required flexibility, and the pivotal role of community knowledge to fit the standards to the actual set up. The study sought the "productive deviation" of health workers from the standards when required

depending on the stance of the real context, which was crucial for both data quality and health service provision. This research emphasizes that the data captured at the community level needs to be used by the health sector in order to improve data quality in the routine HIS in the developing country context.

Another important issue emphasized in this thesis is the knowledge communication across boundaries in day-to-day practices of HEWs (Paper V). This paper builds upon the earlier papers in that it analyzes the knowledge communication practices within the complex setting of public health sector in a developing country. The knowledge communication, as described in this paper, was taking place among the public health actors that include community volunteers, rural households, HEWs and their teachers and supervisors. A theoretical notion of “knowledge boundaries and communication” (Carlile, 2002; 2004) is used to understand the challenges related to communicating the novel knowledge concerning the health extension packages. A key implication arising from this analysis is the need to nurture the existing potentials that facilitate communication and mitigate the constraints that inhibit knowledge communication across boundaries. From this study, it was elaborated that the knowledge brokering role of HEWs and community volunteers can enhance knowledge sharing across boundaries in the public health sector of Ethiopia that is discussed in detail in section 5.3.

In summary, as indicated in Figure 5.1, together these five papers have helped me to address the key research aim of the study; understanding the nature of community knowledge, and how this knowledge domain is used and communicated in the public health sector of a developing country that in turn may improve the routine HIS and health service to the public.

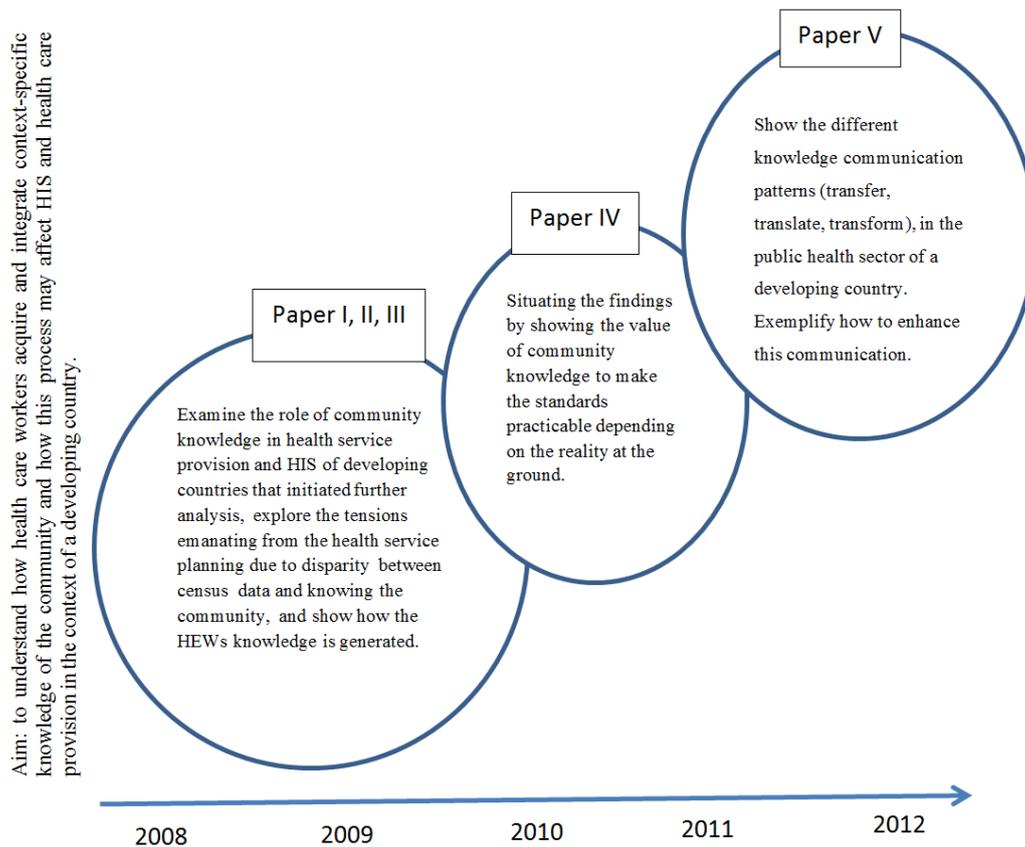


Figure 5.1: Linkage between papers appended in this thesis

5.3 HEWs and Community Volunteers as Knowledge Brokers

In their day-to-day practices, HEWs discuss, converse and negotiate with households thereby helping them to practice health actions and enjoy healthy lives. HEWs play a role of knowledge broker by facilitating knowledge communication between the health extension packages (source of knowledge from the scientific bases) and the rural community (potential users) through continuous interaction with households. This thesis showed that HEWs and households are specialized in different knowledge domains. They have dependencies in completing a task; hence the boundary is complex (pragmatic). The dependencies between HEWs and households happen from the need of their joint input to implement the health extension packages. For example, the efforts of HEWs to expand the immunization service to all children in their villages, which is part of the health extension packages, can be facilitated or constrained by the parents' awareness and will of allowing their children for the services.

As (Carlile, 2004: 2002) has put it, communicating knowledge between people with different knowledge domain and high dependency faces a pragmatic boundary that requires transforming the current knowledge through close interaction and negotiating of conflicting interests. For example, some parents may consider traditional healing practices, such as

“cutting uvula”, is best for their children’s health. HEWs repeatedly interact and negotiate with households to allow them to transform their current knowledge and implement the innovative health extension packages, rather than such harmful traditional practices. In addition, previously, before the health extension program was launched in Ethiopia, the health service was provided mainly at health facilities on an individual basis and it was predominately curative services (FMOH, 2005; Banteyerga and Kidanu, 2008). Thus, the community assumed that they would get curative service when HEWs were assigned to their villages. Hence, it was a challenge for HEWs to persuade the community about the merit of disease prevention and health promotion programs, rather than cure after acquiring the disease. This was especially common at the beginning of the program. For example, during my visit to a rural health post, I remember the words of a HEW struggling to convince her client; “Look at this woman, she is here to get treatment for her illness, but we are not here to supply drugs...even some of our clients said why you are here if you don’t have drugs to treat us?...”

The other HEW also said “When we started work (at the beginning of the program), the community did not accept us, they wanted to get drugs and injections for every health problems rather than advices on healthy living...”

Although it was not possible to resume the old-ways of doings that gives more emphasis for the curative health services than preventive, currently the health care system allowed HEWs to handle some essential drugs to treat some killer diseases and serious childhood illnesses. For instance, the findings showed that HEWs in some villages have received training on community case management and have started treating children for pneumonia, fever and malaria. The training program included topics on data management and HEWs got well-prepared registers to capture data related to those diseases. The register also incorporated instructions that guided health workers to make diagnosis and identify specific treatments. The findings of this thesis revealed that HEWs were glad since they were able to treat the sick thereby increasing their acceptance by the community as illustrated by the following quote from a HEW; “Although doing both curative and preventive health services added work burden on us, we are glad...since the community is excited to get the curative service ”.

These findings indicated the need of close interaction between the HEWs and rural households, and negotiating of conflicting interests that arise from the commencement of the health extension program. Meanwhile, the undertaking of HEWs to advance knowledge communication across pragmatic boundaries was intensified by the efforts of community

volunteers. For example, a HEW in a rural village said “Villagers trust community volunteers since they are neighbors and they know each other....looking at the health seeking behavior of community volunteers, villagers tend to follow them...hence the presence of community volunteers motivated most households to implement the health extension packages”. This study revealed the importance of continuous negotiation, and the exemplary role of community volunteers to bring the requisite progress in health action. The presence of these local cadres could potentially maximize the implementation of the health extension packages by the rural households. The personal and social connections among neighbors in rural vicinities were found to be strong and such relationships provide opportunities for them to have personal interactions to share knowledge even after work. Most community volunteers implement the health actions to themselves and their family, as well as, motivate their neighbors, relatives and friends to follow healthy living. Both HEWs and community volunteers can take the role of knowledge brokers who are facilitating the communication and use of knowledge regarding the new health initiatives.

A knowledge broker provides a link between the source of knowledge and end users (between the health extension packages and rural households in this case) by developing a mutual understanding of goals and cultures, and collaborates with end users to identify issues and problems for which solutions are required (Kitson et al., 1998). Knowledge brokers are required to build rapport with target audiences and understand the context and processes (Dobbins, 2009). Strategies that are more interactive and involve face-to-face contact show promising results in knowledge brokering (Lyons et al., 2006). As most HEWs and community volunteers live within the community, they know the context, the culture and traditional practices that may help them to make negotiations pertinently. They are also expected to build a trusting relationship with the households they serve. Figure X represents the interactions, which occur between HEWs and households and among rural neighbors.

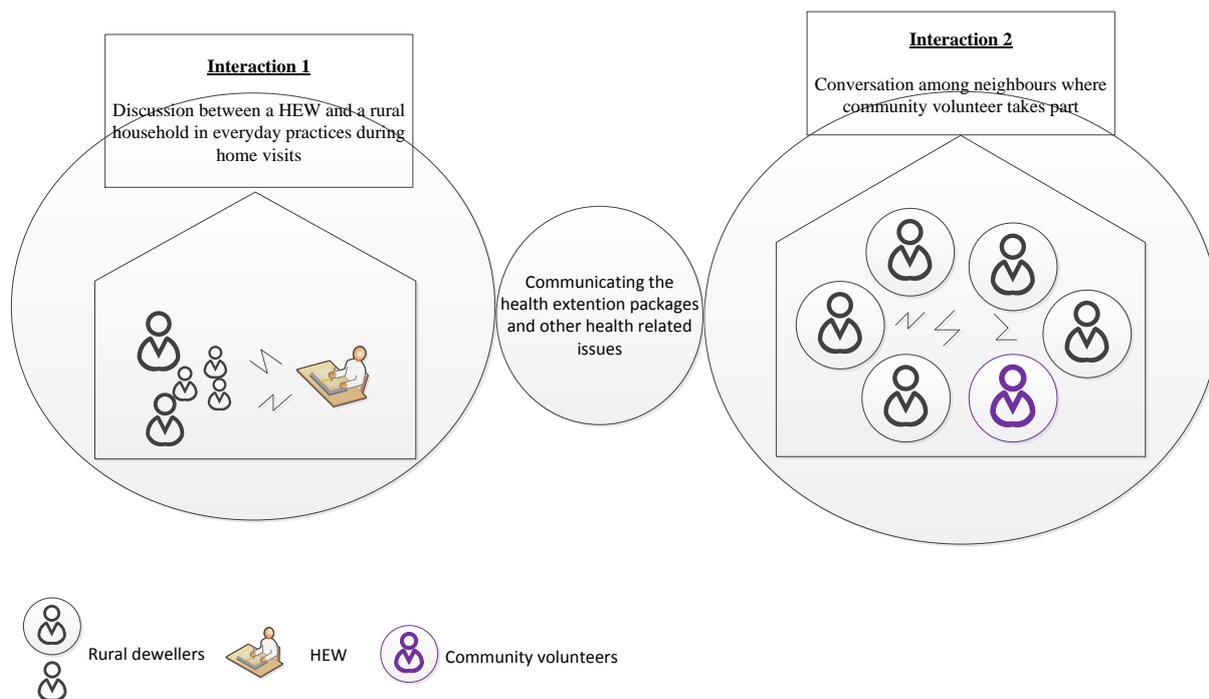


Figure 5.2: Interactions between a HEW and a household, and among neighbors in a rural village.

Figure X presents the interactions that occur between a HEW and a household in their everyday practices of house to house visiting, as well as, between community volunteer and other neighbors in a rural village. The diagram magnifies the brokering role of HEWs and community volunteers through close interactions and negotiations with rural households. Different researchers mentioned that knowledge brokering can contribute to innovation and knowledge communication (Hargadon, 2003; Howells, 2006) and the main task of a knowledge broker is to connect knowledge seekers to sources of knowledge (Dougherty, 1992). This thesis has also revealed the knowledge brokering role of HEWs and community volunteers. These findings have resonance with the study conducted by Pawlowski and Robey (2004) that found IT professionals were positioned as brokers between IT and user communities and among user communities. Another study done by the Leeds Institute of Health Sciences (2009) also revealed that individuals were employed to act as “knowledge brokers” and their job was to facilitate the transfer of knowledge between researchers and practitioners in order to improve the health outcomes.

Advocacy, social mobilization and program communication approaches, as described by Rahman, (2000) were also found useful to develop partnership in day to day practices of HEWs and community volunteers. For instance, program communication is one of their major tasks, since they are expected to select specific target groups (households) and communicate with them about the health issues until these households implement at least 75% of the health

extension packages and graduate. This is mostly done through house to house visiting; negotiation and demonstration (see Paper V). Advocacy and social mobilization are also part of their job, for instance, to prepare or motivate the community for a certain program, such as the health campaign event, screening for HIV/AIDS, etc. Social mobilization demands collaboration with other sectors, such as education and agriculture sectors, and advocacy is mostly done when the community is assembled for other purposes, for example, at the community festivals or at the church mass. These methods help to raise people's awareness on a particular health event and to strengthen the community participation.

This study indicated that the new health services are introduced to rural Ethiopia and the scope of HEW tasks is expanding through time. Consequently, HEWs and community volunteers need to communicate the newly initiated health activities with rural households. As the novelty increases, the amount of difference or gap at the boundary grows (Carlile, 2002). Meanwhile, the knowledge brokering role of HEWs and community volunteers will continue to close the gap and facilitate knowledge transfer, translation and transformation.

Chapter Six: Contributions and Conclusion

This chapter presents answers for the research questions, research contributions and the concluding remarks from this thesis. The previous chapter provided summary of the findings and outlined how the five papers included in the thesis help to answer the research questions. Here the aim is to discuss the detailed answers to the research questions, and the contributions that are made to this research. This chapter is organized around four sections. First, section 6.1 provides answers to the research questions. The theoretical and practical contributions are discussed in section 6.2 and 6.3 respectively. Then the chapter ends with a brief conclusion of this thesis in section 6.4.

6.1 How the research questions were addressed?

This sub-section provides the detail of how the articles included in the thesis answered the research questions. The research questions and their answers are presented as follow;

How can the community knowledge be used in the process of health service provision and health information systems in developing countries?

a. Integrating the community knowledge in the health service provision

As described in Chapter one, community knowledge in this study is the context-specific knowledge of the rural communities in Ethiopia, including HEWs and community volunteers that is used for data management and providing health services. The scientific knowledge is understood to be knowledge with origins outside of the rural communities in Ethiopia, including all scientific principles, strategies, and institutions such as conventions, government policies, working guidelines, rules and regulations (Ruhezai and Kilugwe, 2012).

Several researchers (for example, Wennberg 1991; Timmermans and Berg, 1997; Komaroff 1982; Berg, 1997; Mavimbe, 2006) have described how protocols or guidelines stipulate an explicit order that may be difficult to implement in an actual practice. Hence, the protocols are re-appropriated to make them “do-able” for the participants within their practice. As Timmermans and Berg (1997) put it, the instructions in the working guidelines are designed to guide the person through a sequence of steps. However, the explicit criteria written in the guidelines are tinkered with to make them workable in practice. In this study, this tinkering of guidelines was taking place depending on community knowledge. Hence, the focus is on the pivotal role of community knowledge to fit the standards to the real set up.

This thesis takes into account the standardization and flexibility around the community health service provision and HIS in a developing country. It analyzes how local adaptation and improvisation can be accepted and how the standards are shaped by health workers with community knowledge. With this regard, the working guidelines designed by the health authorities were taken as a standard. The empirical examples of this study reveal how global standards, i.e. the EOS guidelines, were implemented by HEWs and community volunteers in the rural villages in Ethiopia. These guidelines, which guide health workers in health service provision, data collection and reporting, were developed by UNICEF and other health partners, and further adapted by FMOH of Ethiopia.

The guiding assumption within this thesis has been that the elements of the standard i.e. instruction in the guidelines should be categorized as fixed and flexible as described in subsection 5.1.4. This research found HEWs and community volunteers followed the standardized guideline strictly with respect to some aspects, and deviated on other aspects, while performing the health service provision, data collection and reporting. They were able to employ alternative practices rather than strictly following given instructions in the guideline based on their context-specific knowledge and the available materials. For instance, some parents, especially in the rural areas, did not know the exact age of their children whereas age of the child is crucial for the procedure. Then, health workers, with the help of community volunteers, were able to infer or estimate the age of children using different local clues and the community rituals, such as religious events (Paper IV). This practice indicated how the community knowledge helped health workers to implement the instructions written in the standardized working guidelines. According to the Millennium Ecosystem Assessment (2003), community knowledge is a way of life and it contains information collected over time through the indigenous people interaction with their environment. This knowledge is embedded in the experiences of a given community and involves intangible factors, including their beliefs, perspectives, and value systems (Alan, 2000). For example, it would not be easy for an outsider to infer age of a child using the community rituals when using the calendar method is not possible.

The alternative practices may not be as precise as the standard stipulated, for example, HEWs and community volunteers may not know the exact birth date of a child, but they were able to get the clue that pointed to whether the child is eligible for the EOS service or not. They made it to make their work more productive using their community knowledge and the available materials in their villages. This different ways of doing or alternative practice from the

standard, which is denoted in this thesis as the “productive deviation” from the standard, allowed them to be more effective for both the health service provision and data collection and reporting (see the detail from Paper IV). Hence, an analytic distinction between fixed and flexible elements of a standard was introduced in line with the HEWs and community volunteers’ implementation of the standards in the guidelines. Figure 6.1 depicted a schematic presentation of the analytical framework.

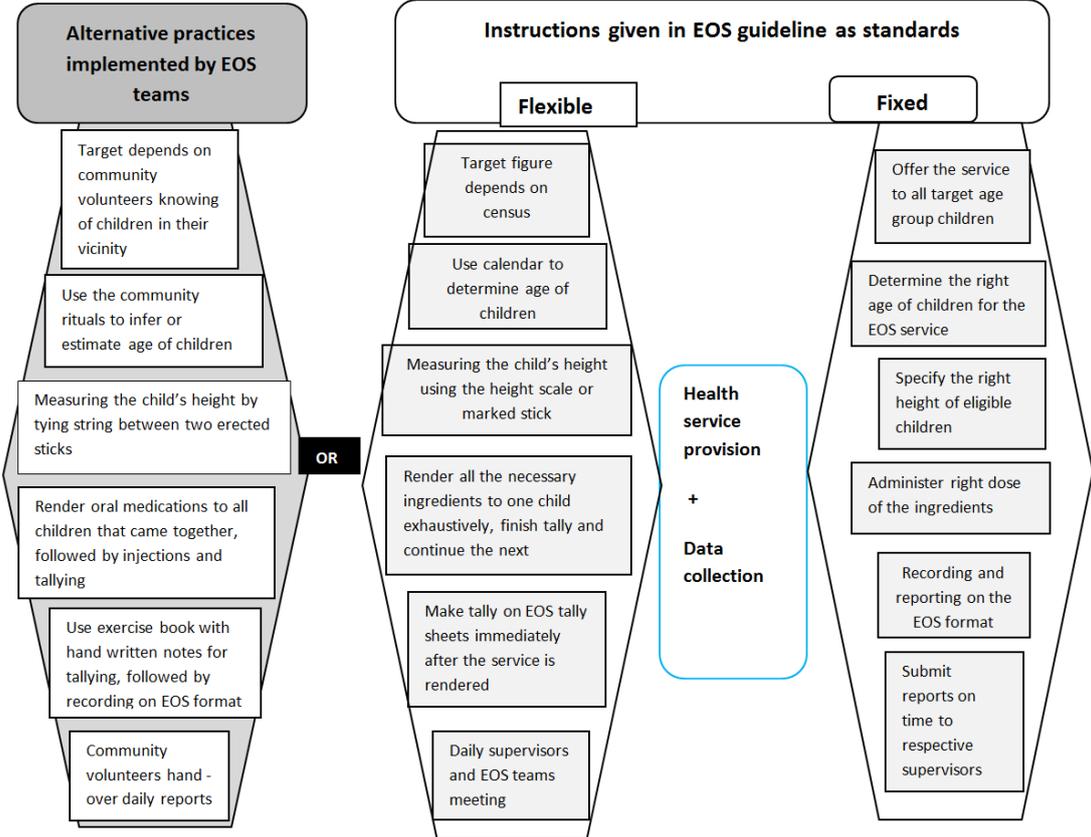


Figure 6.1: Examples of fixed and flexible standards and alternative practices by health workers

The above figure indicates a distinction between some instructions given in the EOS guideline that should not be changed and others which can be replaced by alternative practices. HEWs and community volunteers were following some instructions in the EOS guidelines (the fixed standards) strictly since changing of them could compromise the program’s aim. For instance, they followed the guidelines specification of age group of children that should receive the service, and also they followed the guidelines with respect to the dose of ingredients given to each child. The health workers perceived it as mandatory to follow the guidelines in order to give the right package, to the right child in the right dose. As such, the EOS guidelines were a worthwhile and successful standardization of practices. However, the health workers also sometimes deviated from the guidelines with respect to, for example, how they estimated age

of the child, how they organized administration of the right dose of ingredients, how they collected data and submitted reports.

This distinction and alternative practices were introduced because of the resource and other contextual constraints, as well as, the health workers perceived that they could have a positive effect on both service provision, and data gathering and reporting. The alternative practices were taken as other means that contributed to the same ends, i.e. without compromising the aims. Then, this thesis is categorizing the elements of the standards itself as fixed and flexible, depending on the work done by the HEWs and community volunteers, with community knowledge. Health workers knew the program's objectives well enough since they took the required pre-campaign trainings. Trainings take place before the campaign begins, and the EOS campaign is usually organized twice per year in Ethiopia, hence health workers and community volunteers are familiar with aim of the campaign (Paper IV). Moreover, their supervisors followed them throughout and trusted the alternative ways of completing the task. This thesis categorizes the criteria that distinguish fixed from the flexible component of the standard related to the distinction between means and ends. The means, i.e. the procedures and actions to achieve the ends, were considered flexible enough to be changed, while the ends i.e. the program's aims to offer the required service to children, were not considered flexible or changeable.

In the context of health care, sharing the perspectives of Timmermans and Berg (1997), this thesis also emphasized that updated and practical standards of performance that can guide health workers in their daily work are needed. However, the standards, instructions in the guidelines, protocols, etc. cannot be precisely implemented as stipulated thereby modification and adaptation is a requisite. This study revealed the need of acknowledging the importance of community knowledge to make the standards workable in practice in resource constrained settings, such as Ethiopia.

This thesis showed that HEWs and community volunteers mostly had community knowledge. As such, this community knowledge is commonly informing their practices (Paper I, II and IV). They sometimes deviate from the guidelines developed centrally and implement alternative practices based on their community knowledge and the material they have at hand; something which could have a positive effect for both service provision and HIS (Paper IV). Thus, it suggests the need to find options to incorporate the input from the local practices and the community knowledge while developing and revising the working guidelines. For example, the local improvisations and productive deviations from the standard by the

knowledgeable community health workers (Paper IV) may actually be worthwhile to be incorporated into a revised version of the standard guidelines.

Moreover, in the health sector of Ethiopia, health workers including HEWs are selected based on their good performances and present their performance reports and work practices at the meetings organized by the RHBs and also FMOH. These presentations may denote knowledge transfer. HEWs also regularly meet with community volunteers, the health center staff, and their district supervisors to discuss their performance reports and other health related issues. Different ideas are discussed in these meetings. These public health actors make discussions to learn about the sources that create semantic differences among themselves and try to develop common solutions. This thesis suggests relevant practices originated from these boundary processes were found beneficial to be integrated with the scientific sources. The health authorities at the national and regional levels need to transform their practice and incorporate such local inputs to the national standards.

There are plenty of good practices originated from community knowledge that contribute to the health of the public, such as, the indigenous postpartum maternal and child care in Nigeria (Emery, 2000). The author recommended that such beneficial practices need to be integrated with the health care programs. As such, similar useful practices are operating in Ethiopia to be considered and promoted by the health care system. It is also mentioned that utilization of the community knowledge can promote the community involvement and using of the scientific methods (Puri, 2007; Rengalakshmi, 2006). Besides, as Zahra, Neubaum and Larraneta (2007) put it; informal social interactions among people can create useful opportunities to exchange ideas and knowledge for their capacity building. It is known that not all aspects of the indigenous knowledge and practices are beneficial (Brehony, 2000). Thus, the strong social bond and collaboration among the rural neighbors in Ethiopia, and the indigenous community-based institutions (Damtew, 2010; Mengesha, 2011) can serve as hubs that promote useful practices originated from community knowledge and discourage the harmful ones.

b. Integrating knowledge from the community and scientific sources in the HIS implementation

Although the health sector reform in most developing countries focuses on community based health services, using community knowledge and local practices from peripheral level health workers is still limited (Puri, 2003, Piotti et.al., 2006; Kanjo, 2012). These studies indicated that the scientific venture tends to dominate the community knowledge. Although this

knowledge domain is being a dominant form of knowledge in developing countries, it is excluded from the development endeavors, because it is not considered relevant or important, and often not knowledge at all, by the more powerful (Puri, 2003; Rhea, 2004). Moreover, some academics considered community knowledge as primitive and static and they may not assimilate this knowledge domain in development activities. For instance, local environmental knowledge of the rural community in Ethiopia, including the useful practices for crop productivity and environmental protection, were undeservedly discredited because they were held responsible for producing environmental degradation (Hoben, 1995).

These days, in the context of socio-economic development, such marginalization of indigenous knowledge is, to a certain extent, gradually being reversed. However, this slow and grudging recognition notwithstanding, the indigenous knowledge system in the scientific domain, and their use to address field problems, remain a challenge (Puri, 2007). This thesis also presented how the community knowledge compliments the knowledge sources from scientific bases in the public health sector of a developing country. It has showed building up of knowledge alliances between the scientific and community sources can be achieved by; the collaborative work among community volunteers, HEWs, their supervisors and the local district administrator.

Adoption of a community based health service provision through the health extension program in Ethiopia brought about active participation of communities in their own health activities (FMOH, 2005; Banteyerga and Kidanu, 2008). This program brought a structure that facilitates HEWs to work closely with their district supervisors, community volunteers, households and other partners. The findings of this study revealed that HEWs tend to use the population figure known by community volunteers to implement their day-to-day activities, such as immunization. Their district supervisors also showed their keenness to concede the population number generated by HEWs and community volunteers to appraise the effectiveness of health programs implementation in rural villages. The census data is the only official population data distributed until to the district level. Districts distribute the population number projected from census to each village (kebele) within the district depending on the kebele population number they had before. This study showed that there is discrepancy between the actual population data and the projected population number from census (Paper I and II). Consequently, even within the same district, the actual population number in some villages, which is based from the community sources, is less than the officially projected population; and the reverse holds true in some other villages. The responsible person of one of

the visited districts mentioned that they have planned to reshuffle the population number of each village within their district based on the actual data from the HEWs and other community workers. They intended to consider the population number from the community sources (from HEWs, community volunteers and community workers of other sectors, such as agriculture and education) to disaggregate the census data projected to their district to each village within the district. Doing so may help to decrease the problems associated with the health service planning through combining the population data from the scientific (census) and communities (knowing the community and head counted) sources.

In sum, this thesis showed that the population data is a source of conflict in some developing countries, since the population number projected from census differs from the data generated by community health workers (Paper I and II). However, rather than the conflict between the sources of knowledge, from the community and scientific sources, this thesis recommends, there should be a knowledge alliance to utilize the combination of community knowledge and the scientific one. Community health workers mostly conduct door to door visits (Paper I and II) within their locality and they are supposed to collect health data on a daily basis, and they also record vital statistics, such as births and deaths (Center for Global health and Economic Development, 2011; Otieno, 2012). They use the information generated locally, for instance, they take detailed notes on the services provided using ordinary exercise book (Paper I). HEWs and community volunteers perform their everyday work through home visiting in scattered rural villages; they interact with the community, provide health education and services, and capture data. They then use the data for follow up of the health activities of households and to copy the data captured in the field to the main register for reporting. They sometimes create a name based register to document the service given that helped them in capturing data appropriately and searching defaulters of the health service (see the detail from Paper IV). These documents need to be considered, for instance, in the target setting procedures for health services, allocation of resources and development of data collection and reporting tools.

How can knowledge communication among the public health actors be enhanced and contribute to improve health service provision and the routine health information systems?

Knowledge communication in this study refers to the way by which the HEWs share knowledge with other public health actors, including the community volunteers, rural households, peers, their teachers and supervisors.

Data collection tools and health reports can be considered as boundary objects, which enable and constrain knowledge communication across the health care system hierarchy (Damtew and Moges, in press). Hence, having unified data collection and reporting tools at the health facilities can enhance discussion, common understanding and knowledge communication among the health staff (Paper V). Nevertheless, different studies indicated the absence of appropriate data collection and reporting tools at the health facilities as one reason for poor data quality in most developing countries, such as Ethiopia (Mengistu 2005; Damtew, 2005; Mengistie, 2010). It was also noted that there were many registers ranging from 7 to 12 to document different health services at the health posts. Besides, the registers were not uniform across the health posts and districts, as well as, redundancy of data elements was common among the registers (Damtew and Moges, in press). To overcome this problem, standardized data collection and reporting tools are designed by the FMOH to collect and report data from health facilities, and the community HIS was implemented in pilot health posts (Lemma et al., 2010). This thesis emphasizes that such type of efforts need to consider the input from the community health workers (Paper IV).

This thesis also emphasized that the centrally defined programs, standards and guidelines can be integrated with community knowledge so as to provide more relevant instructions. The useful practices that facilitate the health service provision, data collection and reporting need to be assessed and incorporated with the working guidelines for multiplication of beneficial practices. Incorporating the input from community knowledge and local improvisations can increase the opportunity of sharing of knowledge and practice among the public health actors. This in turn may cause new knowledge to be constructed by the health authorities that can be used for further improvement of the public health service and HIS. Mostly, working

guidelines for health workers are prepared at the national level, hence the health authorities at FMOH need to be mindful of such local inputs.

This thesis underscores the need for creating conditions for meaningful interactions among public health actors and multiplication of beneficial practices that may facilitate knowledge communication (paper III, V). Whilst, communicating knowledge is not trivial, especially between people with different knowledge domains and high dependency to accomplish a given task. As (Carlile, 2004: 2002) put it, the three progressively complex types of boundaries— syntactic (structure), semantic (meaning), and pragmatic (practice) — require different processes of knowledge communication that include transfer, translation and transformation.

The findings of this study indicated that different knowledge communication processes were employed among the public health actors (see the detail from Paper V). This subsection focuses on the “pragmatic knowledge boundary” that appears between HEWs and rural households because of the difference in their knowledge domain and high dependency to accomplish the task related to the health extension packages.

Communicating knowledge at the pragmatic boundary requires continuous interaction and negotiation (Carlile, 2004: 2002). Thus, HEWs and community volunteers mostly go to the site or home of the households in order to communicate with them. They act as knowledge brokers who connect the sources of knowledge (the innovative health extension packages and other new health initiatives) with potential users. Such brokering was seen as necessary to promote knowledge communications across the pragmatic boundary. They perform knowledge brokering using different approaches. The home visits enables HEWs and community volunteers to learn more about individual households that help them to identify specific health interventions in order to negotiate conflict of interests and to tailor precise solutions for the health problems in collaboration with the households. This is required since the health extension packages are expected to be implemented through active participation of the households and their own actions and efforts (FMOH, 2005). During home visits, HEWs keep motivating, demonstrating and negotiating with households until they implement the required health actions. Further, their efforts were complimented by community volunteers.

This thesis points out different factors that can impede knowledge communication across boundaries in the public health sector (see the detail from subsection 6.3); hence, the health authorities need to be mindful to minimize these constraints (Paper III and V). To enhance knowledge communication, the health authorities need to mitigate problems that inhibit

comparison and common understanding, such as, the obsolete target and lack of unified data collection tools (Paper III and V). This can be achieved through observing, assessing and facilitating sharing of beneficial practices across the boundaries in the public health sector. This in turn can contribute for the improvement of public health service and HIS.

6.2 Theoretical contributions

6.2.1 Utilization of the community knowledge in shaping standards

This thesis has developed a criterion that distinguishes the fixed from flexible component of a standard related to the distinction between means and ends. Accordingly, the means, which are the actions to achieve the ends, were considered flexible enough to be changed, while the ends were not considered flexible or changeable. This thesis argue that, though the criteria for required, acceptable and/or beneficial deviations from a standard will vary from case to case, the means and ends categorization of elements of the standard can be used in different fields. As such, Timmermans and Berg (1997) identify similar issue, which mentioned about the protocol used by medical doctors. The authors described that medical doctors may go beyond the boundaries of medical protocols, for example, they may give the drug which is not part of the resuscitation protocol in order to save the life of their patients. In this case, the end (aim of the treatment) is to save the life of the patient, and the means (the procedures or actions to achieve the ends) can be appropriated based on the protocol, or medical doctors sometimes deviate from the standards stipulated in the protocol to achieve their aim; i.e. saving the life of their patients. The authors argue that this adaptation of the protocol is not showing the limits of standardization in practice, rather it demonstrates the ongoing subordination and articulation of the protocol to meet the primary goal of the working procedure. Likewise, this study shows the implementation of standards with the required flexibility, using alternative ways of doing based on the community knowledge, rather than strictly following the working guidelines in order to fulfill the purpose of the procedure.

Timmermans and Berg (1997) described how medical doctors were able to augment the resuscitation protocol based on their medical knowledge. Though, the present study explores in what manner the community knowledge and improvisations help in shaping the standards in a resource constraint setting while carrying out health service provision and community data gathering and reporting. Despite the existence of wide range of studies related to standardization and flexibility, as to my knowledge; no attempt has been made to investigate

the role of community knowledge in shaping standards in the public health informatics of a developing country.

This study showed that the alternative procedures implemented by the HEWs and community volunteers have facilitated implementation of the standards written in the guidelines; hence were not compromising the aim of the program. As such, their deviance from the standard enabled HEWs and community volunteers to find better solution for problems encountered in their specific working practice that resulted from shortage of resources and other contextual constraints (see the detail from Paper IV). This “productive deviation” was seen as more effective for both the health service provision and data collection and reporting. The “productive deviations” from the standard mentioned in this study may also be called improvisations or workarounds; however, the important point to note is that this happened only to some elements of the standard.

The findings of this study also indicated the use of name based register, which was created by the community volunteers who know their population, to capture data in addition to the standardized data collection tools. This process was perceived to enhance the data collection and service provision, while still allowing adherence to the standard report formats as described in section V. This practice was an addition to the standards, in the same way as the “hierarchy of standards” principle (Braa and Hedberg, 2002, Woldeyohannes and Molla, 2005, Braa et al, 2007), which indicates the freedom to add, as long as one also confirm to the minimal “core” requirements.

Other studies on standardization and flexibility in HIS (for example, Hanseth et al., 2006; Braa and Hedberg, 2002, Woldeyohannes and Molla, 2005, and Braa et al, 2007) discuss issues relating to systems design and implementation strategy rather than procedural standards, thus issues relating to integration of the community knowledge is not discussed. While the previous studies all point to relevant insights, none of them explicitly discuss how to integrate the community knowledge, which is the main contribution of this study. Neither do these studies explicitly discuss what constitutes allowable deviation from the standard, or offer specific criteria for how to distinguish between appropriate and non-appropriate deviation. This study identified the “means and ends” criteria to categorize the fixed and flexible elements of a standard. The approaches of standardization and flexibility explored in this thesis can be applied to other disciplines other than public health sector and also other than Ethiopia; because the issue of standardization and flexibility is a global issue, and not specific to any one of the country.

6.2.2 The role of knowledge brokers in communicating knowledge across boundaries.

This thesis has conceptualized the efforts of HEWs and community volunteers as knowledge brokering, which is more noticeable at the pragmatic boundary that needed debating, negotiating and transforming the current knowledge of rural households. The recurrent interaction and negotiation of HEWs and community volunteers with rural households to promote the implementation of new health initiatives was denoted as knowledge transformation across a pragmatic boundary. Pragmatic boundaries are especially acute in the early stages of the new service or product development (Carlile, 2004). The findings of this study showed the challenges that HEWs faced in negotiating with the rural dwellers about the benefits of preventive health services rather than curative, especially at the initial stage of the health extension program. Consequently, the findings indicated that the health care system allowed HEWs to handle some essential drugs to treat some killer diseases that in turn increased clients' satisfaction and strengthened the preventive health services.

Carlile (2002, 2004) analyzed the use of boundary objects as a means of representing knowledge of individuals, learning about their difference and dependencies', and then transforming knowledge to resolve the consequences that exist at a given boundary. He also explains a given boundary object is no "magic bullet" when it is used in a situation where its capacity as a type of common knowledge and/or the ability of the actors to use it is not well matched. Boundary objects, such as health reports, working guidelines, strategic plan documents, etc. are also important in facilitating and sometimes constraining the knowledge communication across boundaries in public health sector of Ethiopia. Besides, this thesis emphasized the knowledge brokering role of HEWs and community volunteers in facilitating the communication and use of knowledge regarding the new health initiatives.

Figure 6.2: showed examples of the knowledge transfer, translation and transformation processes across boundaries in the public health sector of Ethiopia.

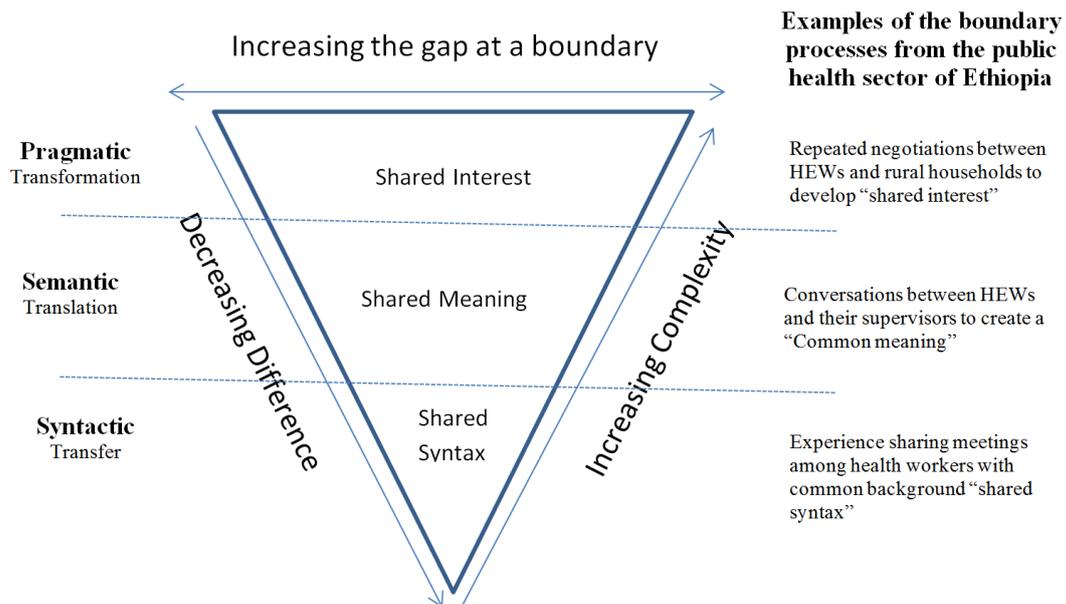


Figure 6.2: Three levels for managing knowledge across boundaries of the increasing complexity (Adapted from Carlile, 2004: 558)

As shown by Figure 6.2, while increasing in difference, dependence and novelty of the knowledge domain of people at the boundary, the gap gets larger and requires progressively more complex forms of communication that include transfer, translation and transformation (Carlile, 2004). Herein, this study emphasized the knowledge brokering role of HEWs and community volunteers in narrowing the gap through continuous interaction at a pragmatic boundary as described in section 5.3. This process facilitates knowledge communication between the health extension packages (source of knowledge from the scientific bases) and the rural community (potential users). The necessity of knowledge brokers as intermediaries is discussed by different authors. For instance, Pawlowski and Robey (2004) revealed IT professionals became brokers through their participation in user communities and by interacting with multiple communities; hence they were able to bridge traditional boundaries separating business units. As such, this study showed the role of HEWs and community volunteers as knowledge brokers in facilitating knowledge communication related to new health initiatives in rural villages of Ethiopia.

This study connects the role of knowledge brokers with Carlile (2002; 2004) managing knowledge across boundaries. Carlile has developed a relevant framework for understanding different knowledge boundaries of varying complexity and showing the different challenges and means required to bridge the different types of boundaries. However, the author doesn't explicitly discuss about the role of knowledge brokers. Hence this study has contributed to

Carlile's framework by specifying the role of knowledge brokers in communicating knowledge across a pragmatic boundary.

In sum, analyzing the different facets that are required for knowledge sharing among public health actors was important to investigate the knowledge communication processes and the challenges that pose in expanding the innovative health extension packages. This perspective can offer additional insights to the knowledge debate, which is scarce in the field of public health informatics and this also helps to alert the health authorities to take an action to mitigate the constraints that inhibit effective knowledge communication.

6.2.3 Establishing knowledge alliances between the sources of knowledge from the community and scientific bases

Health services are based on knowledge; the knowledge of health workers that involves not only science related inputs, but also depends upon the local community knowledge that contributes to find local solutions (Joint Learning Initiatives, 2004). Puri (2007) used the term knowledge alliance for referring not merely to the material characteristics of the knowledge inscribed in technology, but also to the indigenous knowledge of the various communities involved.

This thesis has extended the concept "building up knowledge alliances" from scientific and community sources (Rahman, 2000; Rengalakshmi, 2006; Puri, 2003; 2007, Kanjo, 2012) to the practices of community health service provision and information systems in a developing country. The public health sectors need to build practices that draw on community and scientific knowledge bases. Drawing from Carlile (2002, 2004), new product or service development involves agents coming from various professional fields. In this study, implementing the new health initiatives and information systems entails health professionals with scientific knowledge and rural households with community knowledge, where HEWs and community volunteers act as knowledge brokers between the two knowledge domains. The findings indicated that both HEWs and rural households need to transform part of their practices so as to create a joint practice.

This thesis has demonstrated examples of how knowledge from scientific and community sources combined, the point also discussed by Puri (2007), may help to develop more effective strategy to combat the problems associated with the health service provision and HIS of developing countries. Therefore, it has contributed to the rather limited literatures that have examined the issues of community knowledge in the public health sector. Although there have

been numerous debates both in the IS and management research over what knowledge is and how it may be created and shared meaningfully across diverse contexts, (Walsham, 2005); this issue has not been an active object of study in public health informatics settings especially within the context of developing countries (Lewis, 2012). This thesis intended to contribute to the limited literature (such as Moss, 2005; Kanjo, 2012 and Lewis, 2012) that analyzed the pivotal role of the local community knowledge in the context of public health informatics in developing countries.

This thesis underlined that paying attention to the community knowledge can potentially improve efficiency and would help to create more effective systems. It is widely recognized that development initiatives needs to draw on the rich body of knowledge that community members have acquired. Thus, involving the local community is crucial for effectiveness of implementation and sustainability of the system, such as GIS and HIS (Puri 2003, Piotti et al., 2006). Kanjo (2012) also argued that knowledge of the context is one of the building blocks in information systems development. Generally, integrating the knowledge from scientific and community sources helps to devise sustainable solutions to the development problems (Dube and Musi, 2002). This thesis also suggests that the public health sectors in developing countries need to develop a mechanism to incorporate local inputs arising from the community knowledge to scientific processes or procedures for health service provision and HIS. The following sub-section presents the practical contributions and recommendation arising from this thesis.

6.3 Practical Contributions and Recommendations

This section discusses the two key practical contributions arising from this thesis. The contributions made have implications to both public health and information system domains.

6.3.1 Studying the current practice and propose strategies for effective knowledge sharing and multiplication of beneficial practices.

This thesis shows the relevance of community knowledge to facilitate HIS and health service provision in developing countries. The HEWs and community volunteers were seen as being extremely hard working and committed to their work. They use local materials and the community knowledge that enable them to complete their required tasks even under conditions of scarce resources. They do their work in collaboration with the community and other public health actors. Community volunteers help HEWs to be acquainted with the

community knowledge. However, the study found that the communication between HEWs and TBAs were not sufficient, hence recommended refresher trainings for the TBAs and other community volunteers in order to boost their interest and confidence. Banteyerga and Kidanu (2008) also emphasized that it is important to strengthen the relation among HEWs, community volunteers, the community, and village leadership; hence the health extension program cannot be realized unless these key stakeholders team up and create synergistic effect on the implementation. In the study of modern and traditional health sectors in Malawi, (Kanjio, 2012) also mentioned the need of collaboration between the two sectors in order to improve the data capturing processes at the community level. The author revealed that although it is politically correct for all pregnant women to have their babies delivered at a health facility, the reality is that the health facilities offering maternal services are not enough for all or within every pregnant woman's reach. This practice also holds true in Ethiopia where only about 10% of the pregnant women give birth at the health facilities (Central Statistical Agency, 2012).

This study has also elaborated the constraints that affected the teaching and learning process at the HEWs training schools. The findings indicated low incentives and trainings for teachers resulted in high attrition of experienced teachers, as well as, shortage of facilities that negatively affected the practical sessions. This study recommended that the efforts of HEW teachers to facilitate their communication with the HEW trainees, for example, by making the class room conversation in local language to overcome the language barrier, need to be fostered by offering apt incentives and trainings to teachers. Reading materials, such as handouts prepared in local language, can also be additional resources to minimize the language barrier. The teaching facilities need to be improved and the practical sessions should lengthen to facilitate the teaching-learning process. Standardized data collection and reporting tools need to be available in the demonstration rooms of HEWs training schools thereby HEW trainees can practice capturing, analyzing, reporting and using the community health data that enhance their skill before they start their actual work. Availability of these tools at the HEWs training schools, and also at health facilities can contribute to improving the data quality in routine HIS, as well as, facilitate knowledge communication among the public health actors.

These ideals raise the need to more effective coordination among the different stakeholders in order to improve the HEWs pre-service trainings. The objective of HEWs pre-service training is to produce skilled health workers, assigned at the community or health post level to provide essential health services and document community health information in their respective

villages (Ministry of Education, 2003). There should be more attention to the HEWs training schools by allocating sufficient budget. This requires the collaborative efforts from the government and development partners, who support the community HIS and health service provision. Although HEW training schools are managed by the Regional Technical Vocational, Education and Training Institutions in collaboration with the RHBs, the curriculum for HEWs training was designed at the national level by Ministry of Education in collaboration with FMOH. However, the HEWs curriculum was not revised since it was developed in 2003 until this study was conducted, and HEW teachers repeatedly requested for the curriculum revision (Paper III). The fundamental ideas included in educational curriculum should be revised through time (Bruner, 1996). Besides, the HEW training program is relatively new and teaching materials were developed on the basis of limited experience (Ministry of Education, 2003). Hence, Ministry of Education and FMOH need to amend the existing HEWs curriculum through time by considering the input given by HEW teachers.

Moreover, this thesis shows the mechanisms for alleviating some of the challenges of communicating knowledge in the public health sector of a developing country. The different mechanisms that are required to communicate the new health initiatives among the public health actors, and also the constraints that inhibit effective communication were elaborated. Identifying the different knowledge communication processes could give an insight to the health authorities and other stakeholders on how to nurture different potentials and opportunities to establish effective knowledge communication among the public health actors. This suggests that those who are involved in the implementation of community HIS and the health extension program need to be aware of the efforts to communicate the novel knowledge, and should strive to create conducive environment for knowledge communication.

The findings also showed that district supervisors extend their support to HEWs. They do frequent follow up, and respect the improvisations and productive deviations from the standard by the HEWs and community volunteers. This approach can boost the morale of the community health workers, since the support from supervisors enhance work motivation and job satisfaction of employees (Abramis, 1994). It is crucial to engage with and motivate beneficial practices based on the community knowledge, and such local creativities should be supported and incorporated into the routine practices. The researcher discussed with the respective health managers that some of the local improvisations need to be shared and multiplied as beneficial practices.

In sum, by describing the situation of HEW training schools in Ethiopia and the everyday work practices of HEWs and community volunteers, a contribution is made to develop a better understanding of the practices related to HIS and health service provision at the community level. This can help to reduce the existing gaps related to the community health service provision and HIS in Ethiopia, and other developing countries, which have similar working environment. The focus of this study is at the community level, on the PHC units, i.e. health posts, health centers and district health offices; hence further research is required to establish the effects of community knowledge to the overall efforts to improve the health service provision and HIS of the country.

6.3.2 Proposing mechanisms to deal with the practical challenges related to the health service planning in developing countries.

As presented in the findings of the different research papers included in this thesis; one significant practical contribution of this study is analysis of the target setting procedure or health service planning in developing countries. Throughout my research, I have identified the potentials and challenges related to the target setting procedures and local creativities, which can affect the day-to-day practices of community health workers directly or indirectly. Through my different papers, I have tried to analyze the problems emanating from the target setting procedures for health services, and how the community volunteers, HEWs and their district supervisors dealt with the situation. During my field work, it was seen that HEWs were confused because of the gap between the target figures provided by the district authorities, which was high in most cases, and the population number known by them. The study identified that most health managers agreed that the target figure projected from census has problems, and the population number known by HEWs is more reliable. However, some interviewed district staffs mentioned that, in rare cases, health workers including HEWs may deliberately deduct the number of population in their catchment area, to maximize the coverage of their health service performance. The findings showed that the district health staffs try to verify the population data in their catchment areas, for example, through making a search in randomly selected households to confirm the required health services have been properly reached.

Although target is an essential element of planning as it allows health workers to be responsive to the endeavour of their efforts, studies showed that the health service planning in some developing countries used the population data based on the census, which is sometimes unreliable. For instance, Mavimbe et al., (2006) argue that the target setting in Mozambique

depends on the national level regulations, with limited consideration of the grass root level health workers' endorsement. Our study conducted in three developing countries of Africa (Paper I) also indicated that most of the health status indicators in South Africa were based on population data from census; however, there were some differences between the census and the actual population data in the catchment areas. The same study also showed that community health workers in Malawi acquire relevant knowledge about the population which they serve. Thus, some district offices prefer to rely on the head counted population done by the community health workers, rather than the population figures projected from census.

This thesis also evidenced that the efforts of district managers to identify the ambiguity related with the population figure can be supported by additional resources from locally collected data. This study identified that name based registers, sometimes created by community volunteers, can also be used to confirm the number of target population in a given village. Besides, some health partners, who are working in some districts of Ethiopia related to a specific health service, require registering the number of family members in each household, which can also help to verify the number of population in a given village or district. Another approach, towards the target setting procedure can be implemented using different mechanisms by considering the population data both from the scientific and community sources as described in section 6.1.

The strategies identified cannot be considered as universal solutions to deal with the challenges for the health service planning in different contexts and settings. Rather, they can be used as points of departure to emphasize the importance of considering the reality and the community knowledge. This approach focused on supporting the formulation of local solutions depending on the context to encounter the challenges associated with the health service planning in particular, and the HIS and health service provision in general. The findings of this thesis reinforced the argument made by (Piotti et al, 2006) that revealed when rules are imposed by higher levels with little understanding and acceptance of the peripheral staff, it subsequently leads to only partial compliance. This thesis, therefore, has emphasized the importance of pertinent target setting procedure for health services and the health staff participation in planning in order to raise job satisfaction and performance.

6.4 Concluding Remarks

The purpose of this study has been to understand the role of community knowledge in the public health care sector of a developing country. The founding argument was that combining such knowledge domain with scientific sources can help to improve the community health service provision and HIS. Using the qualitative interpretative case study, this study empirically shows how developing countries and resource-constrained settings could use the community knowledge to lessen the challenges associated with health service provision and information systems. These shifts come about not only from the building of knowledge alliance from the scientific and community sources, but also as a result of the collaborative efforts among the public health actors and reformation of health services to community level.

Theoretically, the thesis draws upon knowledge domains including community knowledge, scientific knowledge, and knowledge boundaries and communication. The concept of standardization and flexibility were also used to emphasize the role of community knowledge in shaping the standards. These concepts allowed developing a theoretical framework that shows the central role of community knowledge to compliment the knowledge from scientific sources in day-to-day practices of HEWs. Based on the findings, this thesis has developed framework that categorize the changeable and non-changeable elements of the standard related to the means and ends. Hence, it has argued that this framework can be useful also in domains other than health and other than Ethiopia. Another important issue highlighted was to describe the knowledge boundaries and communication processes in the public health sector, and the role of HEWs and community volunteers as knowledge brokers. By analyzing the day-to-day practices of these peripheral level health workers, this thesis contributed to the practice-based perspectives.

This thesis is not of merely theoretical significance, but also carries important practical implications for both public health and information systems domains. It has presented an in-depth theoretically informed empirical analysis of efforts made to improve the community health service and HIS in rural Ethiopia. This research emphasizes the need to nurture the existing knowledge communication practices, and also addresses the constraints that inhibit knowledge communication across boundaries among the public health actors. While these contributions have been derived from the empirical materials and experiences in the context of Ethiopia, arguably, these can be used by practitioners, health managers, HIS specialists and other stakeholders also in other developing countries.

References

- Abramis, D. (1994). Work role ambiguity, Job satisfaction, and job performance: Meta-Analysis and Review. *Psychological Reports*, 75(3, Pt 2) 1411-1433.
- Alavi, M., and Leidner, D. (2001). Review: Knowledge Management and Knowledge Management Systems: Conceptual Foundation and research issues. *MIS Quarterly*, 25 (1), 107-136.
- Amhara Region Health Bureau Report (2011). Bahirdar, Ethiopia
- Argote, L. (1999). *Organizational learning: Creating, retaining, and transferring knowledge*. Norwell, MA: Kluwer.
- Banteyerga, H., and Kidanu, A. (2008). *Rapid Appraisal of Health Extension Program: Ethiopia Country Report*. Lk10 Project Ethiopia, Addis Ababa, Ethiopia.
- Banteyerga, H., Akililu, K., Conteh, L., & McKee, M. (2011). *Ethiopia: Placing Health at the Center of Development*. ghlc.lshtm.ac.uk/files/2011/10/GHLC-book.pdf. Retrieved on 15/07/ 2012.
- Berman, P. A, Gwatkin, D. R., and Burger, S.E. (1987). Community-based health workers: head start or false start towards health for all? *Soc Sci Med*, 25(5):443–459.
- Berg, M. (1997). Problems and Promises of Protocol. *Social Science and Medicine* 44(8): 1081-1088.
- Bolman, L.G., & Deal, T.E. (2003). *Reframing Organizations: Artistry, Choice and Leadership*. JOSSY-BASS publication, United States of America.
- Bonner, A. & Tolhurst, G. (2002). Insider-outsider perspectives of participant observation. *Nurse Researcher*, 9(4): 7-19.
- Bowker, G., & S.L. Star. (1999). *Sorting things out: Classification and its consequences*. MIT press, MA, USA.
- Braa, J., and Hedberg, C. (2002). The struggle for district-based health information systems in South Africa. *The Information Society*, 18(2): 113-127.
- Braa, J., Hanseth, O., Heywood, A., Mohammed, W., & Shaw, V. (2007). Developing Health Information Systems in Developing Countries - the flexible standards strategy. *MIS Quarterly*, 31(7): 381-402.
- Brehon, B. (2000). Whose practice counts? Experiences in using indigenous health practices from Ethiopia and Uganda. *Development in Practice*, 10 (5): 650-661.

- Briggs, J., Pulford, I. D., Badri, M., & Shaheen, A.S. (1998). Indigenous and scientific knowledge: the choice and management of cultivation sites by bedouin in Upper Egypt. *Soil Use and Management*, 14 (4): 240-245.
- Briggs, J. (2005). The use of indigenous knowledge in development: problems and challenges. *Progress in Development Studies*, 5(2):99-114.
- Brouwers, J. (1993). Rural people's response to soil fertility decline: The Adja case (Benin), *Wageningen Agricultural University Papers*, 93-4.
- Brown, J. S., and Duguid, P. (2001). Knowledge and organization: A social practice perspective. *Organization Science*. 12 (2): 198–213.
- Bruner, J. (1996). *The process of Education*. MA: Harvard University Press Cambridge.
- Carlile, P. R. (2002). A pragmatic view of knowledge and boundaries: boundary objects in new product development. *Organization Science*, 13(4): 442-455.
- Carlile, P.R. (2004). Transferring, Translating, and Transforming: An Integrative Framework for Mapping Knowledge across Boundaries. *Organization Science*, 15(5): 555-568.
- Centre for Global Health and Economic Development (2011). *Community Health Workers Scale up*. http://cghed.ei.columbia.edu/?id=projects_chw, Accessed on 04/05/2012.
- Central Statistical Agency (2012). *Ethiopian Demographic and Health Survey (EDHS, 2011)*. Addis Ababa, Ethiopia.
- Chaulagai, C. N., Moyo, Christon M, Koot, Jaap, Moyo, Humphrey, B.M., Sambakunsi, Thokozani C., Khunga, Ferdinand M. & Naphini, Patrick, D. (2005). Design and implementation of a health management information system in Malawi: issues, innovations and results. *Health Policy and Planning*, 1-10.
- Chilundo, B., & Aanestad, M. (2004). Negotiating multiple rationalities in the process of integrating the information system of disease specific health programs. *Electronic Journal on Information Systems in developing Countries*. 20(2): 1-28.
- Cook, D. N., & Brown, J. S. (1999). Bridging epistemologies: The generative dance between organizational knowledge and organizational knowing. *Organization Science*, 10(4): 381–400.
- Creswell, J. (2003). *Research design: Qualitative and mixed methods approaches*, Second edition. University of Nebraska, Linkon: 119-142.
- Damtew, Z., (2005). *Management information systems of HIV/AIDS, TB and Malaria in Ethiopia*. University of Eduardo Mondlane, Unpublished Master Thesis, Mozambique, Maputo.

- Damtew, Z., (2010). Using Local Knowledge in Information Gathering Process: Case study from Ethiopia. Published at IST-Africa 2010 Conference Proceedings, 1-7.
- Damtew, Z., Miscione, G., Molla, S., Østmo, I.E., Staring, K., Sæbo, J., & Sun, V. (2010) Globetrotting health information systems. *Journal of Health Informatics in Developing Countries*: 4(1): 27-38.
- DeLyser, D. (2001). Do you really live here? Thoughts on insider research. *Geographical Review*, 91(1): 441-453.
- Denzin, N., (1970). *The Research Act: A Theoretical Introduction to Sociological Methods*. Chicago, Aldine.
- De Vries, H. (2006). IT Standards Typology, in Jakobs, K. (ed.): *Advanced Topics in Information Technology Standards and Standardization Research*, Hershey: Idea Group Publishing, 1: 1-26.
- Dobbins, M., Robeson, P., Ciliska, D., Hanna, S., Cameron, R., O'Mara, L., DeCorby, K., & Mercer, S. (2009). A Description of a Knowledge Broker Role Implemented As Part of a Randomized Controlled Trial Evaluating Three Knowledge Translation Strategies. *Implementation Science*, 4(23): 1-16.
- Dougherty, D. (1992). Interpretive barriers to successful product innovation in large firms. *Organization Science*, 3 (2): 179–202.
- Dube, M.A. & Musi, P.J. (2002). *Analysis of Indigenous Knowledge in Swaziland: Implications for Sustainable Agricultural Development*. Published by the African Technology Policy Studies Network. ATPS Working Paper Series No. 34
- Dwyer, C. & Buckle, J.L. (2009). The Space Between: On Being an Insider-Outsider in Qualitative Research. *International Journal of Qualitative Methods*. University of Alberta: 54-63.
- Ellen, R. & Harris, H. (1996). Concepts of indigenous environmental knowledge in scientific and development studies literature – A critical assessment. Draft Paper Presented at East-West Environmental Linkages Network workshop 3, Canterbury.
- Ellis, C. S. (2005). Meaningful consideration? A review of traditional knowledge in environmental decision making. *Artic*, 58 (1): 66 – 77.
- Emery, A.R. (2000). *Guidelines: Integrating Indigenous Knowledge in Project Planning and Implementation*. Washington DC, USA.
- Fernandez, M.E. (1994). Gender and indigenous knowledge. *Indigenous Knowledge & Development Monitor*, 2 (3): 6-7.

- Finch, C.R. & Crunkilton, J.R. (1999). Curriculum development in career and technical education. Boston: Allyn and Bacon, 3-22.
- FMOH-Ethiopia. (2005). The Health Sector Strategic Plan (HSDP III). Addis Ababa, Ethiopia.
- FMOH-Ethiopia. (2006). HMIS Business Process Reengineering assessment report. HMIS core process. HMIS Reform Team. Federal Ministry of Health, Addis Ababa.
- FMOH-Ethiopia. (2007), Health Extension Workers Profile. Addis Ababa, Ethiopia.
- FMOH-Ethiopia. (2008). Health Management Information System (HMIS)/ Monitoring and Evaluation (M&E) Strategic Plan for Ethiopian Health Sector. HMIS Reform Team. Federal Ministry of Health, Addis Ababa.
- FMOH-Ethiopia. (2010). Health Sector Development Plan IV: 2010/11-2014/15. Addis Ababa, Ethiopia.
- Gherardi, S. (2000). Practice-based Theorizing on Learning and Knowing in Organizations'. *Organization Science*, 7 (2), 211-223.
- Grover, V. & Davenport, T.H. (2001). General Perspectives on Knowledge Management: Fostering a Research Agenda. *Journal of Management Information Systems*, 18(1), 5-21.
- Habarurema, E. & Steiner, K. G. (1997). Soil suitability classification by farmers in southern Rwanda. *Geoderma*, 75: 75-87.
- Hargadon, A. & Sutton, R. (1997). Technology brokering and innovation in a product development firm. *Administration Science Quarterly*, 42: 716-749.
- Hanseth, O., Jacucci, E., Gristo, M. & Aanestad, M. (2006). Reflexive standardization: side effects and complexity in standard making. *MIS Quarterly*, 30 (Special issue): 563-581.
- Heywood, A. & Rohde, J. (2000). Using information for action: A manual for health workers at the facility level, University of Western Cape, Equity project.
- Hirpa, W., Tesfaye, H., Nigussie, F. & Argaw, H. (2010). Implementation of an Integrated Health Management Information System and Monitoring and Evaluation System in Ethiopia: Progress and Lessons from Pioneering Regions. *Quarterly Health Bulletin*, 3 (1): 47-54.
- Hoben, A. (1995). Paradigms and politics: the cultural construction of environmental policy in Ethiopia. *World Development*, 23 (6): 1007-1021.
- Howells, J. (2006). Intermediation and the role of intermediaries in innovation. *Research Policy*. 35(5): 715.

- International Council for Science (ICIS), (2002) 'Science and traditional knowledge', report from the ICSU Study Group on Science and Traditional Knowledge. Accessed on 2/2/2013 from <<http://www.icsu.org>>
- International Institution of Rural Reconstruction, (1996). Recording and Using Indigenous Knowledge: *A Manual, International Institute of Rural Reconstruction*, Silang, Cavite, Philippines.
- James, W. (1907). Pragmatism. The American Library, New York.
- Kakabadse, N.K., Kouzmin, A., & Kakabadse, A., (2001). From Tacit knowledge to Knowledge Management: Leveraging invisible assets. *Knowledge and Process Management*, 8(3): 137-154.
- Kanjo, C. & Kaasbøll, J. (2011). Influence of Information Generated from Traditional Practices on Health information systems. IFIP 9.4. Social implications of computer in developing country proceedings, 11th international conference, Nepal.
- Kanjo, C., (2012). In Search of the Missing Data: A case from Maternal and Child Health Data in Malawi. Faculty of Mathematics and Natural Sciences, University of Oslo. PhD Thesis.
- Kaplan, B. & Maxwell, A. (1994). Qualitative Research Methods for Evaluation of Computerized Information System: Evaluation Health Care Information System Methods and Applications. Thousand Oaks: Sage Publication.
- Kapoor, I, (2002). The devil's in the theory: a critical assessment of Robert Chambers' work on participatory development. *Third World Quarterly*, 23 (1): 101-117.
- Katsulukuta, A. (2010). Malawi: Making use of community health workers to improve coverage opportunities and challenges. *The Global Immunization meeting*.
- Kitaw, Y., Ye-Ebiyo, Y., Said, A., Desta, H., Teklehaimanot, A. (2007). Assessment of the Training of the first intake of health extension workers. *Ethiopian Journal of Health Development*, 21(3):232-239.
- Kitson, A., Harvey, G., & McCormack, B. (1998) Enabling the implementation of evidence based practice: a conceptual framework. *Quality Health Care*, 7 (3):149–158.
- Klein, H.K. & Myers, M.D. (1999). A set of principles for conducting and evaluating interpretive field studies in information systems. *MIS Quarterly*, 23(1): 67-93.
- Komaroff, A. (1982). Algorism and the art of medicine. *American Journal of Public health*, 72: 10-12
- Krickeberg, K. (2007). Principles of health information systems in developing countries. *Health Information Management Journal*, 36(3): 8-20.

- Kaasbøll, J. (1987). International Development of Professional Language through Computerization: A case-study and theoretical considerations. Proceedings of the IFFP working conference, North Holland.
- Lagebo, B. and Molla, S. Challenges and approaches to Scaling and Standardizing the Health Information Infrastructure in Developing Countries. Case studies from Ethiopia. Master Thesis. Oslo University. Informatics Department, 2005.
- Lave, J. (1988). Cognition in practice: Mind, mathematics and culture in everyday life. Cambridge: Cambridge University Press.
- Law, J. (1986). On the Methods of Long-distance Control: Vessels Navigation and the Portuguese route to India", John Law (ed.): Power, Action and Belief: A New Sociology of Knowledge, London: Routledge & Kegan Paul, 234-263.
- Leeds Institute of Health Sciences, (2009). Knowledge brokering: transferring research into practice. <http://www.leeds.ac.uk/lihs/psychiatry/knowledgetransfer1.html>. Retrieved on August 12, 2012.
- Lemma, I., et al., (2010). Information tool for better health care in rural communities: Making Family Folder Operational. Quarterly Health Bulletin, 3(2): 27-34.
- Lewis, J. (2012). Moving from technology for information to information for local action: Case from public health in India. Faculty of Mathematics and Natural Sciences, University of Oslo. PhD Thesis.
- Lippeveld, T. & Sauerborn; R. (2000). Routine data collection methods. Design and implementation of health information systems. Edited by Lippeveld T., Sauerborn R. and Bordrat C., WHO, Geneva, 2000.
- Lippeveld, T. (2000). Routine data collection methods. Design and implementation of health information systems. Geneva, Switzerland.
- Lomas, J. (2007). The in-between world of knowledge brokering. BMJ. 334: 129–32.
- Lyons, R., Warner, G., Langille, L., & Phillips, S.J. (2006). Moving population and public health knowledge into action: A casebook of knowledge translation stories. Ottawa, ON: Canadian Institutes of Health Research (CIHR) Institute for Population and Public Health.
- March, J. (1972). Model bias in social action. Rev. Ed. Res. 44: 413–429.
- Ma Rhea, Z. (2004). The preservation and maintenance of the knowledge of Indigenous peoples and local communities: the role of Education. AARE Conference, 1-15. <http://www.aare.edu.au/04pap/mar04956.pdf>. Accessed on 20/06/2013

- Matias, E. (1994). *Indigenous Knowledge and Sustainable Development*. Working Paper No 53. International Institute of Rural reconstruction, Y.C James Center, Silang, Philippines, 1994.
- Mavimbe, J. et al., (2006). Immunization coverage in Mozambique: From concepts to decision-making. *Health Policy* 79 (1): 92-100.
- Mavimbe, J. (2007). *An Informational Perspective to the Analysis of the Expanded Program of Immunization: Case Study from Mozambique*. Faculty of Mathematics and Natural Sciences, University of Oslo. PhD Thesis.
- Mengesha, N. (2011). *Revisiting Networks of Action and Knowledge Transfer: An outline of practice and community based approach for open source information systems implementation in Developing countries: Cases from Ethiopia*. Faculty of Mathematics and Natural Sciences, University of Oslo. PhD Thesis.
- Mengistu, B. (2005). *Assessment of the management information systems for Maternal and Child Health in Ethiopia*. University of Eduardo Mondlane, Unpublished Master Thesis, Maputo, Mozambique.
- Mengiste, Shegaw A. (2010). *Analysing the challenges of IS implementation in public health institutions of a developing country: The need for flexible strategies*. *Journal of health informatics in Developing Countries*, 4 (1) : 1-17.
- Mercer, J., Kelman, I., Suchet, P, & Iloyd, K. (2009). *Integration of the indigenous and the scientific knowledge Bases for disaster risk reduction in Papua New Guinea*. *Swedish Society for Anthropology and Geography*, 157-183.
- Meyer, M. (2010). *The Rise of the Knowledge Broker*. *Science Communication*. 32 (1): 118-127.
- Ministry of Education, 2003. *One year middle level TVETI program curriculum Guide*. Addis Ababa, Ethiopia.
- Miles, M.B. & Huberman, A.M. (1994). *Qualitative Data Analysis: An Expanded Source Book*. Thousand Oaks, Sage Publications.
- Millennium Ecosystem Assessment, (2003). *Ecosystems and human well-being: A framework for assessment*. Washington, DC: Island Press.
- Ministry of Education, (2010). *Progress report*. Addis Ababa, Ethiopia.
- Moss, E. (2005). *Understanding the Introduction of computer-based information systems in developing countries: counter networks, communication practices and social identity: A case from Mozambique*. Faculty of Mathematics and Natural Sciences, University of Oslo. PhD Thesis.

- Mwadime, Robert K. N. (1999). Indigenous knowledge systems for an alternative culture in science: the role of nutritionists in Africa. Pp.243- 267 in Semali, Ladislaus M. and Joe L. Kincheloe (Eds.). What is indigenous knowledge? Voices from the academy. New York and London. Falmer press.
- Myers, M. D. (1997). Critical Ethnography in Information Systems, in A.S. Lee, J. Liebenau, and J. I. DeGross (Eds.) Information Systems and Qualitative Research, London: Chapman and Hall, 276-300.
- Myres, M. D. & Avison, D. (2002). Qualitative research in Information Systems: A reader. Sage publications, London, UK.
- Mørk, B.E. (2009). Changing Practices: A Practice-Based Study of Cross-Disciplinary Technology Study in Hospitals. Faculty of Medicine, University of Oslo. PhD Thesis.
- Nicolini, D., Gherardi, S. & Yanow D. (2003). Knowing in organizations. A Practice-Based Approach. M.E. Sharpe Inc.
- Nicholson, B. & Sahay, S. (2004). Embedded Knowledge and Offshore Software Development, Information and Organization, 14 (4): 329-365.
- Nonaka, I. (1994). A dynamic theory of organizational knowledge creation. Organization Science, 5 (1): 5 14–37.
- Nonaka, I. & Takeuchi, I. (1995). The Knowledge-Creating Organization. Oxford Press, Oxford, U.K.
- Obomsawin, R. (1988). First Nations Jurisdiction over Education. *Assembly of First Nations*, Ottawa.
- OECD, (2003). Poverty and Health in Developing Countries: Key Actions. OECD Policy Brief, OECD, Paris.
- Orlikowski, W.J. & Baroudi, J.J. (1991). Studying Information Technology in Organizations: Research Approaches and Assumptions. Information Systems Research, 2 (1): 1-28.
- Orlikowski, W. (2002). Knowing in Practice: Enacting a Collective Capability in distributed Organizing. Organization Science, 13 (3): 249-273.
- Ostberg, W. (1995). Land is coming up: the Burunge of central Tanzania and their environments. Stockholm Studies in Anthropology, Stockholm.
- Otieno, C.F., Kaseje, D., Ochieng, B.M., & Githae, M.N. (2012). Reliability of Community Health Worker Collected Data for Planning and Policy in a Peri-Urban Area of Kisumu, Kenya. Journal of Community Health, 37(1): 48-53.
- Oudwater, N. & Martin, A. (2003). Methods and issues in exploring local knowledge of soils. Geoderma, 111(3-4): 387-401.

- Pawlowski, S. & Robey, D. (2004). Bridging user organizations: knowledge brokering and the work of information technology professionals¹. *MIS Quarterly*, 28(4): 645.
- Payton, R.W., Barr, J. J., Martin, A., Sillitoe, P., Deckers, J. F., Gowing, J. W., Hatibu, N., Naseem, S. B., Tenywa, M. & Zuberi, M. I. (2003). Contrasting approaches to integrating indigenous knowledge about soils and scientific soil survey in East Africa and Bangladesh. *Geoderma*, 111: 355-386.
- Piotti, B., Chilundo, B. & Sahay, S. (2006). An Institutional Perspective on Health Sector Reforms and the Process of Reframing Health Information Systems: Case Study from Mozambique. *The Journal of Applied Behavioral Science*, 42(1): 91-109.
- Polanyi, M. (1996). *The tacit Dimension*. Doubleday and company, New York.
- Puri, S. (2003). *The Challenges of Participation and Knowledge in GIS Implementation for Land Management: Case Studies from India*. PhD Thesis, University of Oslo, Norway.
- Puri, S. (2007). Integrating scientific with indigenous knowledge: Constructing knowledge alliances for land management in India. *MIS Quarterly*, 31 (2): 355-379.
- Rajasekaran, B., Warren, D.M. and S.C. Babu (1991). Indigenous natural-resource management systems for sustainable agricultural development – A global perspective. *Journal of International Development*, 3 (1): 1-15.
- Rahman, (2000). *Development of an Integrated Traditional and Scientific Knowledge Base: A Mechanism for Accessing, Benefit-Sharing and Documenting Traditional Knowledge for Sustainable Socio-Economic Development and Poverty Alleviation*. UNCTAD Expert Meeting on Systems and National Experiences for Protecting Traditional Knowledge, Innovations and Practices. Geneva.
- Reij, C., Scoones, I. & Toulmin, C. (eds) (1996). *Sustaining the soil: indigenous soil and water conservation in Africa*. Earthscan Publications, London.
- Rengalakshmi, R. (2006). *Harmonizing Traditional and Scientific Knowledge Systems in Rainfall Prediction and Utilization* in Fikret Berkes et al., eds. Washington, DC: Island Press.
- Rolls, K.D., Kowal, D., Elliott et A.R. Burrell (2008). Building a state wide knowledge network for clinicians in intensive care units: Knowledge brokering and the NSW Intensive Care Coordination and Monitoring Unit (ICCMU). *Australian Critical Care*, 21(1): 29-37.
- Sandiford, P., Annet, H., Cibulskis, R. (1992). What can information systems do for primary health care? An international perspective^{ll}, *Social Science and Medicine*, 34(10): 1077-1087.

- Sauerborn, R. and Bordrat, C. (2000). Introduction. Design and implementation of health information systems. Geneva, Switzerland, World Health Organization.
- Seidel, J. (1998). Qualitative Data Analysis. The Ethnography v5 Manual, Appendix. Available online at: <http://www.qualisresearch.com/11> accessed in April, 2010.
- Senanayake, S. (2006). Indigenous knowledge as a key to sustainable development. *The Journal of Agricultural Sciences*, 2(1): (87-94).
- Shannon, C. & Weaver, W. (1949). *The Mathematical Theory of Communications*. University of Illinois Press, Urbana, IL.
- Shaw, V., (2009). A complexity inspired approach to co-evolutionary hospital management information systems development. PhD Thesis, university of Oslo.
- Silverman, D. (2005). *Doing Qualitative Research*. London: Sage Publications.
- Smyth, A. & Holian, R. (2008). Credibility issues in research from within Organizations. In P. Sikes & A. Potts (Eds.). *Researching education from the inside*, 33–47. New York, NY: Taylor & Francis.
- Sosthenes, R & Zuenka, K. (2012). Integration of the indigenous and the scientific knowledge systems for conservation of biodiversity: Significances of their different world views and their win-loss relationship. *Journal of Sustainable Development in Africa*, 14 (6): 160-174.
- Star, S. L. (1989). The structure of ill-structured solutions: Boundary objects and heterogeneous distributed problem solving. M. Huhns, L. Gasser, eds. *Readings in Distributed Artificial Intelligence*. Morgan Kaufman, Menlo Park, CA.
- Starfield, M., Shi, L., & Macinko, J. (2005). Contribution of Primary Care to Health Systems and Health. *The Milbank Quarterly*, 83 (3), 457–502.
- Suchman, L. A. (1994). Working Relations of Technology Production and Use. *Computer Supported Cooperative Work*, 2: 21-39.
- Sverrisson, A., (2001). Translation networks, knowledge brokers and novelty construction: pragmatic environmentalism in Sweden. *Acta Sociologica*. 44: 313-327.
- Szulanski, G. (1996). Exploring external stickiness: Impediments to the transfer of best practice within the firm. *Strategic Management Journal*. 17: 27-43.
- Timmermans, S. & Berg, M. (1997). Standardization in Action: Achieving Local Universality through Medical Protocols. *Social Studies of Science*, 27(2): 273-305.
- Timmermans, S. & Berg, M. (2003). *The Gold Standard: The Challenge of Evidence-Based Medicine and Standardization in Health Care*. Temple University Press: Philadelphia, PA.

- Timmermans, S. & Leiter, V., (2000). The redemption of Thalidomide: Standardizing the Birth Defects. *Social Studies of Science*, 30(1), 41-71.
- Van de Ven, A. (2007). *Engaged Scholarship: A Guide for Organizational and Social Research*. Oxford University press. New York.
- United Nations, (2011). *The Millennium Development Goals Report 2011*. New York.
- USAID, 2013. Archives for Global Health. <http://blog.usaid.gov/category/health/global-health-health>. Accessed on 2/2/2013.
- Walsham, G. (1993). *Interpreting Information Systems in Organizations*, Wiley, Chichester.
- Walsham, G. (1995). Interpretive case studies in IS research: nature and method. *European Journal of Information Systems*, 4: 74-81.
- Walsham, G. (2005) —Knowledge management systems: representation and communication in context. *Systems, Signs and Actions*, 1(1): 6-18.
- Walter, B. (1968). Society as a complex adaptive system in: *Modern systems research for the behavioural scientist*. Walter Buckley ed., 490-513.
- Warren, D.M. (1991). *Using Indigenous Knowledge in Agricultural Development*. *World Bank Discussion Papers No. 127*. Washington, D.C. The World Bank.
- Wennberg, J. (1991). Unwanted variation in the rules of practice. *Journal of the American Medical Association*, 265: 1306-1307.
- Wenger, E. (1998). *Communities of Practice: Learning, Meaning and Identity*. Cambridge University Press, Cambridge, U.K.
- Wenger, E. (2000). *Communities of Practice and Social Learning Systems: Organisation Science*, 7 (2): 225 - 246.
- World Health Organization, (1978). *The Declaration of Alma-Ata*. International conference on primary Health Care, Alma-Ata, Kazakhstan.
- World Health Organization, (2002). *Macroeconomics and Health, Investing in health*, Geneva, Switzerland.
- World Health Organization, (2007). *Community health workers: What do we know about them? The state of the evidence on programs, activities, costs and impact on health outcomes of using community health workers*. Evidence and Information for Policy, Department of Human Resources for Health Geneva, January 2007.
- World Health Organization. 2010. *Accelerating Progress towards the Health –Related Millennium Development Goals*. Accessed on 12/01/2012 from http://www.who.int/topics/millennium_development_goals WHO/ .

- World Health Organization & Global Health Workforce Alliance 2010. Global Experience of Community Health Workers for Delivery of Health Related Millennium Development Goals: A Systematic Review, Country Case Studies, and Recommendations for Integration into National Health Systems. Accessed on 01/10/2011 from www.who.int/workforcealliance/.../alliance/Global_CHW_web.pdf.
- World Bank, 2012. Country Report-Ethiopia. Accessed 27 March, 2013 from <http://data.worldbank.org/country/ethiopia>
- Yin, R. (1994). Case study research: design and methods. Sage, Newbury Park, CA.
- Zach, S.A. (1999). Managing Codified Knowledge. *Sloan Management Review*, 40(4): 45-58.
- Zahra, S.A., Neubaum, D.O. & Larraneta, B. (2007). Knowledge Sharing and Technological Capabilities: The Moderating role of family involvement. *Journal of Business Research*, 60(10): 1070-1079.
- Ziam, S., Landry, R. & Amara, N. (2009). Knowledge Brokers: a Winning Strategy for Improving Knowledge Transfer and Use in the Field of Health. *International Review of Business Papers*, 5 (4): 491-505.
- Zussman, R. (2004). People in Place. *Qualitative Sociology*, 27 (4): 351-363.