UNDERSTANDING THE INTRODUCTION OF COMPUTER-BASED HEALTH INFORMATION SYSTEMS IN DEVELOPING COUNTRIES: COUNTER NETWORKS, COMMUNICATION PRACTICES, AND SOCIAL IDENTITY
A CASE STUDY FROM MOZAMBIQUE

by

Emílio Luís Mosse

Submitted in partial fulfillment of the
requirements for the degree

Doctor Scientarium

At the Faculty of Mathematics and Natural Sciences
University of Oslo
Norway

December 21, 2004

Dedicated to

Eufrásia, Aldén and my family for their love and support.

CONTENTS

APPENDIXES

i) Mosse, E. and S. Sahay (2001) Counter Networks and Social Exclusion: The case of Health Information in Mozambique. In the Proceedings of *Information Systems Research Seminar in Scandinavia (IRIS 24)*, Ulvik in Hardanger, Norway.

ii) Mosse, E. and S. Sahay (2003) Counter Networks, Communication and Health Information Systems: A Case Study from Mozambique. In *The IFIP TC8 & TC9/ WG8.2+9.4 Working Conference on Information Systems Perspectives and Challenges in the Context of Globalization*. M. Korpela, R. Montealegre and A. Poulymenakou (Eds), Athens, Greece**:** 35-51.

iii) Mosse, E. and S. Sahay (2005) "The Role of Communication Practices in the Strengthening of Counter Networks: Case experiences from the health sector of Mozambique", In *Journal of Information Technology for Development* (Forthcoming).

iv) Mosse, E. and P. Nielsen (2004) "Communication Practices as Functions, Rituals and Symbols: Challenges on computerization of paper-based information systems", In *Electronic Journal for Information Systems in Developing Countries* 18(3).

v) Mosse, E. and E. Byrne (2005) "The Role of Identity in Health Information Systems Development: A Case Analysis from Mozambique", In *Journal of Information Technology for Development* (Forthcoming).

LIST OF TABLES

LIST OF FIGURES

ABBREVIATIONS AND ACRONYMS USED

ACSs	Agentes Communitários de Saúde
AIDS	Acquired Immune Deficiency Syndrome
ANT	Actor-Network Theory
CIUEM	Informatics Center of the Eduardo Mondlane University
DHIS	District Health Information System
GDP	Gross Domestic Product
GIS	Geographical Information Systems
GNI	Gross National Income
GNP	Gross National Product
HDR	Health Development Report
HISP	Health Information Systems Program
HIV	Human Immunodeficiency Virus
ICTs	Information and Communication Technologies
IDRC	International Development Research Centre
IMF	International Monetary Fund
MoU	Memorandum of Understanding
NGOs	Non-Government Organizations
PARPA	Plano de Acção da Redução da Pobreza Absoluta
PDA	Personal Digital Assistant
PESS	Plano Estratégico para o Sector de Saúde
PHC	Primary Health Care
SIS	Sistema de Informação para a Saúde
SNS	Sistema Nacional de Saúde
TB	Tuberculosis
UNDP	United Nations Development Program
UNICEF	United Nations Children's Fund
WHO	World Health Organization
WHR	World Human Report

ACKNOWLEDGEMENTS

First of all, with my highest sense of gratitude I wish to thank my advisor Professor Sundeep Sahay without whom this work would not be possible to accomplish. I am deeply indebted to him for providing thoughtful guidelines for my research and detailed comments on the multiple draft versions of this thesis and the papers, during numerous discussions over these four years. I am gratified to my second advisor, Professor Jørn Braa whose vision is always ahead. There are no words to describe the support provided by him right from the beginning of this project. I hope that the outcome will help to bring into being the vision he has in his mind.

I extend my gratitude to Professor Judith Gregory for devoting time to reading and discussing my writings, and for her valuable comments especially on the line of argument. Professor Judith, Margunn Aanestad and Petter Nielsen were most helpful in the "mock" defense of the penultimate draft of this thesis in which they provided a solid and constructive critique that I hope has been addressed.

I am also deeply grateful to Petter Nielsen and Elaine Byrne who not only co-authored some of the papers included in this thesis, but also provided useful and thoughtful critiques on the early drafts of this thesis. Gratitude goes again to Elaine Byrne and Bob Jolliffe for accepting my visit to their home.

To my great fellow colleagues and friends Esselina Macome, Humberto Muquinque, José Leopoldo Nhampossa, Baltazar Chilundo, João Carlos Mavimbe, Gertrudes Macueve, Jagrati Jani and Unni Johannessen for encouragement and support in many ways. Gratitude is also extended to António Sitói and Bruno Piotti from Ministry of Health of Mozambique who provided support and research access to my field sites. Great thanks belong to the HISP Mozambique team.

Support from all of the faculty of the Information Systems research group in the Institutt for Informatikk, University of Oslo, is highly appreciated, particularly the support from Jens Kaasbøl, Tone Bratteteig, Ole Hanseth, Kristin Braa, Geoff Walsham and Christina Mörtberg. Thanks go also to my colleagues from the Department of Mathematics and Informatics, University of Eduardo Mondlane.

I want to thank numerous colleagues at the Institutt for Informatikk: Jyotsna Sahay, Satish Puri, Faraja Mukama, Juma Lungo, Edoardo Jaccuci, Miria Grisot, Honest Kimaro, Marisa D'Mello, Zubeeda Quraishy, Patrick Burasa, Usha Srinath, Shegaw Mengiste, Jennifer Blechar, Lise Østmo and Gian Marco Campagnolo. Many thanks go to Jennifer for providing editing of this thesis and some of the papers. In addition, I extend my thanks to colleagues throughout the HISP Network.

Acknowledgements also go to those people not listed here but they *know* that in some way or another they helped to enrich this work. With great respect, I thank the health staff who gave their time for interviews for this thesis. I also extend my gratitude to the many reviewers who provided useful comments on the papers I have written for conferences and journals.

I extended my gratitude to Sture Troli, Isabel and Nora for their support and friendship.

Financial support from the QUOTA programme and HISP is highly appreciated. I am grateful to the International Students Office, University of Oslo, for their support and extend my gratitude to Karen Johansen and Michele Nysæter.

Last but not least, very especial thanks go to Eufrásia and Aldén for their love, and to my parents Alzira Zacarias and Matetete Mosse Luís for their support and encouragement during this project.

Understanding Introduction of Computer-Based Health Information Systems in Developing Countries: Counter Networks, Communication Practices, and Social Identity

A Case Study From Mozambique

ABSTRACT

The thesis presents an in-depth theoretically informed empirical analysis of the efforts to introduce computer-based health information systems in disadvantaged health districts of Mozambique. Situated within the umbrella of the Health Information Systems Program (HISP) action research framework, the research reported in this thesis reflects upon the experiences of working at the micro-level of the health facilities, and also at the "macro-level" of the national level, and also in various other province and district offices.

The four research questions guiding this study are: (i) What are the characteristics of a "counter network" in relation to the Primary Health Care (PHC) sector of a disadvantaged remote area, for example in Mozambique?; (ii) What are the characteristics of the communication practices within and between different levels of the health structure – how are they constituted, expressed and shaped?; (iii) How does an understanding of the relationship between communication practices and social identity provide insights into the dynamics of health information systems introduction?; and (iv) How can a context-sensitive understanding of communication practices and social identity enable the development of more effective practical health information systems introduction strategies?

The theoretical basis of this thesis rests on three key conceptual ideas: (i) counter networks; (ii) communication practices; and (iii) social identity. While the idea of counter networks helps to emphasize the particularities of the context, communication practices elaborates on the micro-level activities of the health staff and its relation to the health information systems. The notion of social identity helps to understand more deeply how the health staff view themselves and its implications on communication. These three theoretical ideas, taken together, help to conceptualize the social world of the health staff,

and its interaction with the efforts to introduce computer-based health information systems. The underlying argument is that understanding this social world is important as it helps to analyze the relations of people and activities to the efforts to introduce computer-based health information systems.

The research strategy adopted was based on an interpretive approach carried out within two health districts of Mozambique during the period of 2000-2003, where the HISP initiative for the introduction of computer-based health information systems was ongoing. The empirical base was provided through nearly 102 interviews, visits to three provinces and 17 health districts, detailed study of documents, participant observation, and engagement in action research efforts such as training and software customization. The thesis is structured around 5 papers, 3 of them are published in Journals and 2 in the proceedings of international conferences on information systems.

The contributions, both theoretical and practical, relate both to public health and information systems research. Three key theoretical contributions arising from the thesis relate to counter networks, communication practices and social identity. A key contribution concerns the conceptualization of the notion of counter networks, and the importance of the PHC sector to join the "network society" to make visible the health status and problems and help advocate for more locally sensitive interventions. Importantly, it is pointed out that such a historically existing disadvantaged context, not only creates challenges to the computerization efforts, but also develops potentialities such as the ability to share limited resources and improvise in emergent conditions. A second key contribution concerns the conceptualization of communication practices in a mutually constituting and constituted relationship with health information systems. Supporting communication practices has important implications for the strengthening of the informational culture and capabilities of the PHC sector. A third contribution refers to the notion of social identity which helps to further understand the "why" of communication practices. Health staff are seen to be members of multiple social groups responsible for both providing health care and performing administrative tasks such as those related to health information systems. The manner in which the health staff identify with these groups, has implications on communication practices and with it the health

information systems. Taken together, these three ideas help to elaborate on the social world of the health staff, and provide an analytical lens to study the interaction of the computerization efforts with this social world, and the tensions that are inherent in this process.

The practical contributions are primarily in terms of identifying locally specific and context-sensitive interventions to strengthen communication practices and the associated information culture. Three key interventions identified are: (i) being sensitive to both the physical and social aspects of communication and for building approaches that take them in conjunction; (ii) dealing with the structural constraints that shape communication practices, such as transportation and roads access; and (iii) changing the focus of what is being communicated, where not only the functional aspects of information are emphasized, but also the symbolic and ritualistic meanings that are inscribed.

CHAPTER ONE

1.1. INTRODUCTION

The Primary Health Care (PHC) sector in developing countries is usually the key entity responsible for providing health care services to the population, especially within rural areas. Currently, attempts are being made by national, state and local governments to introduce various reforms in this sector, such as decentralization, integration of different health programs, strengthening of management practices, and the introduction of Information and Communication Technologies (ICTs) to strengthen the health information systems (Lippeveld et al. 2000). The focus of this thesis is on computer-based health information systems, and the challenges in introducing them in Mozambique. There are various complexities inherent in these efforts arising from different reasons. For example, there are typically multiple vertical health programs (such as for HIV/AIDS, TB, Malaria) each operating with their own Information Systems. Integrating these systems, which are often funded by different donor agencies, is not an easy task as they have political implications. Also, there are multiple administrative levels (community, district, province and national) involved in the health information systems each with their own information needs. Trying to harmonize and cater to these different needs is another difficult undertaking. Typically, the PHC sector is significantly under-resourced both in terms of materials and people, and staff are overburdened with work often making it difficult to motivate them to engage with new efforts such as the introduction of ICTs.

In this thesis, I analyze challenges related to communication practices within this complex setting of the PHC and how these shape the introduction of computer-based health information systems. Communication practices refer to the processes that surround the construction, collection, analysis, and transmission of routine health data within and across the various levels of the health administration hierarchy. A multidisciplinary approach drawing from Information Systems, Public Health, and Sociology is used to understand the challenges related to the introduction of computer-based health information systems. A central assumption being made is that a deep understanding of

these communication practices and their relationship with information flows can provide meaningful insights to develop effective strategies to introduce computer-based health information systems to support PHC services in the context of developing countries.

This thesis takes a social systems perspective to study the challenges raised while introducing ICTs into the work processes in the health sector. A social systems perspective emphasizes the interconnectedness of the technical and social elements, and the socio-historic and political contexts within which the implementation is situated (Walsham 1993). In this thesis, a key aspect of the social system approach adopted is the focus on understanding existing communication practices within the Mozambican health system, their interrelationship with information flows, and how these intersect with efforts to introduce computer-based health information systems.

The chapter is organized in six sections. In the following section, I provide the research motivation drawing upon the relationship between health care, information and social development, and the potential as well as challenges of ICTs to strengthen this linkage. These discussions lead to the next section where the research questions examined in this thesis are presented. In the subsequent section, I briefly describe the research approach adopted to conduct the empirical research, and outline the expected contributions of the study. Finally, in the last section, I present the organization and structure of the thesis.

1.2. Research motivation: the significance of health information systems in social development

Over the years, many developing countries including Mozambique have relied on aid from international agencies, such as the World Bank, as a key strategy for development. Within this framework, development is measured primarily using economic indicators like the increase in per capita income (Mansell and Wehn 1998) and ignores issues such as social context and people's capabilities. However, since the late 1980's and early 1990's, this economic bias has been criticized for not delivering the promised practical results, and as being top down (Puri 2003), externally defined (Green 2002), failing to improve people's quality of life (Kling 1990), and being driven by commercial interests (Escobar 1995) ignoring the non-material aspirations of the population (Bezanson and

Sagasti 1995). In addition, this focus has been described as being too simplistic and not accounting for the reality and local context (Esteva 1987; DuBois 1991; Sachs 1992). Such critiques have contributed to a reconceptualization of social development[1] to also include the well-being, capabilities and aspirations of the people.

Sen conceptualizes social development in terms of existing social opportunities, which he refers to as 'arrangements that society makes for education, health care and so on, which influence the individual's substantive freedom to live better (Sen 1999a, p. 39)'. Sen's focus is on the well-being of the citizens and their assets and capacities to understand development (Sen 1999a)**.** This contemporary approach to development includes taking into account inter-connected factors in conceptualizing development such as economic facilities, social opportunities, and human capabilities amongst others. This conceptualization emphasizes how a lack of fundamental assets such as employment opportunities and health care, can deprive individuals from participation in development activities and contributes to a state of social exclusion (Room 1995; Castells 1996; Sen 1998, 1999a). This focus on the understanding of capability deprivation helps to highlight aspects of poverty often not visible if development is measured only using economic indicators.

Despite the efforts of governments in developing countries to improve living conditions, including the prioritization of health care services at the policy level, the majority of their populations still face intractable development challenges (World Bank 2004). The existing inequality of living conditions especially in the health status of the people and the distribution of basic services between, as well as within countries, adversely shape the social development processes. The recent Human Development Report (HDR 2004) describes that the majority of the population in developing countries is still living in hunger, and poverty, are facing high disease burdens, and have limited access to sanitation and health care services. Poor health status is an important dimension of deprivation and adversely influences social development. Therefore, an approach to

[1] The concept of social development has been debated in various fields including public health. See for example, WHO/UNICEF (1978) Health for All,. Alma Ata, URSS, World Health Organization; Castells, M. (1999) Information Technology, Globalization and Social Development, *In United Nations Research Institute for Social Development (UNRISD) (Discussion paper N 114).*

social development needs to fundamentally consider, amongst other issues, increasing access to health care which can potentially contribute to poverty reduction, to increase peoples' standard of living, and to support overall social development processes. Sen argues that such a framework calls for broadening the informational basis for development. With respect to evaluative approaches concerning development choices, Sen argues:

> Each evaluative approach can, to a great extent, be characterized by its informational basis: the information that is needed for making judgments using that approach and – no less important – the information that is "excluded" from a direct evaluative role in that approach. Informational *exclusions* are important constituents of an evaluative approach (Sen 1999a, p. 56).

This need to strengthen health information systems has also been emphasized by the recent World Health Report (WHR 2004), which states that health information systems are needed to better support health interventions and improve access to health services. For example, the problem of maternal mortality often results from patients living in rural areas not being able to reach the clinic on time when needed due to distance and lack of transportation. If information about the geographical spread of pregnant women and of existing clinics can be provided more effectively, authorities can take steps, for example, to improve transportation or strengthen outreach support, to try to deal with the problem of poor access, and with it at least to some extent, the maternal mortality problem. Therefore, the responsibility to provide health care to the broader community, and to serve as the hub for the health information systems rests with the PHC structure which I now present.

1.2.1. The Primary Health Care approach: the role of health information systems

The PHC sector in most developing countries is based upon the 1978 World Health Organization Alma-Ata conference declaration which emphasized decentralization and a focus on preventative care as essential principles to promote health services "for all by 2000" (WHO/UNICEF 1978). Primary Health Care represents a preventive and holistic approach to health care which emphasizes the delivery of health care services to the

community as opposed to the traditional hospital based approach of curative care (WHO/UNICEF 1978). The ongoing reforms in the health sector of developing countries provide opportunities through projects with available funding and modern technologies to help increase the visibility of disparities in health status, strengthen the existing health information systems, and reorganize existing delivery systems. The health information systems are expected to provide health managers with a systematic tool for decision-making, which ideally should support the PHC goals of provision of health care to all, especially at the peripheral levels. Two key goals of the PHC based approach as summarized from the Alma-Ata declaration are:

I. To address the main health problems in the community, providing promotive, preventive, curative and rehabilitative services accordingly;

II. That all governments should formulate national policies, strategies and plans of action to launch and sustain primary health care as part of a comprehensive national health system and in coordination with other sectors. To this end, it will be necessary to exercise political will, to mobilize the country's resources and to use available external resources rationally.

Information can be seen as one key resource within this PHC framework both for making visible existing health status, and for improving coordination across different health services. Typically, both these goals have been difficult to achieve in practice due to various problems, and a majority of the population in the developing world still lives in very desperate conditions with inadequate sanitation and limited access to health care. Thus, even 35 years after the Alma-Ata declaration, the ambitious dream of “health for all” is yet to be achieved.

The PHC approach is supposed to serve as the basis for reforms and the decentralization of health services including the central role of health information systems to support decision-making, surveillance, reporting to higher levels of the health hierarchy, and improving and coordinating within and across health programs (Murray and Frenk 2000; Braa and Hedberg 2002). The PHC approach entails the development of a district-based health information system to integrate various disparte information systems – paper and

computer-based – so as to provide a holistic view of the health status of a region, and thus to better coordinate intervention efforts. The basic assumption is that PHC services should be offered and managed using small geographic and demographic areas as the unit of focus so as to achieve effective communication with both the higher levels of the administration (Ministry of Health) and also the community. This framework has direct implications on the health information systems for enabling the local use of information (Opit 1987), and consequently for strengthening the health information systems at all levels of management (WHO/UNICEF 1978; Lippeveld et al. 2000).

In theory, the district-based health information systems are expected to enable more effective planning and delivery of health care services (Braa and Nermunkh 2000) including the effective use of resources. But implementing changes to improve the health information systems in developing countries in general has been extremely problematic (Lippeveld et al. 2000). Some of the reasons for this are now discussed.

1.2.2. Challenges in implementing health information systems in developing countries

In many developing countries, it is now being increasingly acknowledged 'that no longer it is productive to debate "are computers good or bad for developing countries?" but instead the need is to address the question of "how can the potential of ICTs be harnessed to address locally relevant problems?" (Sahay and Avgerou 2002, p. 74).' In their development strategies, governments in developing countries are increasingly emphasizing the need to apply ICTs towards attempts to achieve socio-economic progress (Sahay and Walsham 1997; Mansell and Wehn 1998; Mejias et al. 1999; Madon 2000; Silva and Figueroa 2002). This emphasis also arises from the pressure of international agencies on developing countries to use ICTs as instruments of structural adjustment programs (like those in the health sector) which involve a significant outlay of financial resources. Sahay and Avgerou (2002), in their introduction to a special issue of ICT in developing countries in The Information Society Journal, argue that despite the potential of ICTs to support development processes, this has been extremely difficult to achieve in practice. They argue the reasons for this as follows:

> Nevertheless, it is well known that such developmental benefits have been difficult to achieve for a variety of complex reasons. There are two interrelated problems here. First, many organizations have difficulties in nurturing and cultivating complex technology projects over the long period of time that are typically required. Second, the resulting ICT-based systems may have little impact on the organizational weakness they were intended to alleviate (Sahay and Avgerou 2002, p. 73).

Over the years, information systems researchers have identified a variety of challenges in implementing ICTs effectively both in developed and developing country settings. In developing countries, which are the focus of this thesis, there are various contextual particularities related to politics, infrastructure, human resources constraints, institutional condition, and design approaches (Sahay and Avgerou 2002). Heeks (1998) argues that a majority of ICT-based initiatives end in various degrees of failure. He distinguishes between four types of failure: *Total failure*: a system that never works; *Partial failure*: a system in which major goals are unattained or in which there are significant undesirable outcomes; *Sustainability failure*: a system that succeeds initially but then fails after a year or so; *Replication failure*: a pilot scheme that cannot be reproduced (Heeks 1998).

Over the years, researchers have identified various impediments to effective implementation, which shape the consequent "failures" of systems. For example, Puri (2003) discusses the challenges in introducing Geographic Information Systems (GIS) for land management in India. He emphasizes the role of politics, especially how scientists retain control over the technology at the expense of users. Mosse and Sahay (2003) discuss how poor infrastructure conditions, including the lack of transport, impede the flow of health information from the district to the provincial level of the health administration hierarchy. Odedra et al. (1993) discuss human resources constraints and donor influences contributing to unsuccessful implementations of ICTs in sub-Saharan Africa (Odedra et al. 1993). Silva and Figueroa (2002) discuss the role of power and politics, especially as those exercised by international agencies in the context of ICT implementation in Guatemala. Critiquing the common approaches of how systems are "designed from nowhere" and implemented into the contexts of developing country, Suchman emphasizes the tensions between the global and local information systems

practices (Suchman 2002). Sahay and Walsham (1996) further discuss the role of institutional bureaucracy in India in constraining the implementation of GIS. They provide the following example of this bureaucratic functioning:

> Decision making is often confined to a central official who, despite having inadequate knowledge about the technology, is responsible for taking critical decisions related to implementation (Sahay and Walsham 1996, p. 388).

While the effective implementation of ICTs is indeed difficult to achieve, attempts to apply health information systems come with their own particularities and challenges. For example, the existence of multiple health programs such as TB, HIV/AIDS, each with their own information systems contributes to a state of fragmentation and redundancy, making the integration of systems a big challenge (Chilundo and Aanestad 2003). The multiplicity of levels of the health administrative hierarchy (sub-district, districts, province and national), each with their own needs regarding data and reports contributes to the complexity of creating a uniform system while still respecting the particularities of individual levels. Braa and Hedberg (2002) describe the challenges in harmonizing the different information needs of various administrative levels and programs in the context of South Africa. They argue for the creation of a "hierarchy of data standards", where the lower level has the flexibility to make changes in their data sets while not changing what data is sent to the higher level. The same logic then applies to the next level, thus requiring the creation of a "hierarchy of standards." However, creating this system in practice requires negotiations and agreements of the different entities involved (district, province, national authorities, health program managers, international agencies, etc), and is thus a politically charged process.

Most developing countries are funded by international donor agencies in order to support the provision of health services to the population, such as Immunization, HIV/AIDS management, etc. However, this dependence on aid often limits the ability of local health managers to work with locally relevant information (Chilundo and Aanestad 2003). Moreover, donor policies tend to support the implementation of vertical programs, contributing to the fragmentation of health information systems (ibid.), and conflicting with the PHC goals of integrated district based health information systems. Donor aid

also is often directed towards large, complex, and expensive projects like telemedicine, which fail in their implementation, and lead to suboptimal utilization of scarce resources (Braa and Blobel 2003).

Other challenges of implementation of health information systems comes with respect to the problems of scale (Braa et al. 2004) and sustainability (Braa et al. 2004; Kimaro and Nhampossa 2005) of systems. For example, Braa et al. (2004) point out how the uneven distribution of human and technical infrastructure makes it problematic to scale up district-based health information systems in Mozambique because some of the remote districts do not even have electricity. In addition, qualified doctors are often not willing to go to rural areas, making it problematic for systems to be operated effectively in remote regions (Mosse and Sahay 2003). The reliance of the health sector on foreign experts and project based funding also makes it problematic to sustain the systems after the project is completed and the experts leave (Heeks 2002; Silva and Figueroa 2002).

Despite these complexities, there have been some examples reported in the literature of effective use of ICTs in the health sector. For example, Cecchine and Scott (2003) describe the attempts to use Personal Digital Assistants (PDAs) by auxiliary nurse midwives in Andhra Pradesh, India. They claim that the use of PDAs helped to reduce the redundant paperwork and improve data accuracy, which freed up to 40 percent of the nurses' work time, contributing to their improved motivation, and more effective information flows to the upper levels of the administration. PDA technology has also been used in Ghana to conduct public health surveys targeting mothers and caregivers during immunization campaigns, and to facilitate planning and future measles immunization programs (Galblum 2002). In Sub-Saharan Africa, the Internet is being reported to be used for the daily monitoring of cases of meningitis and to help coordinate vaccination programs by rapidly mobilizing medical personnel (UNDP 2001).

However, despite some reported sporadic successes, attempts by developing countries to deploy and implement ICTs to their full potential remains largely unrealized (Sahay and Avgerou 2002; Sein and Harindranath 2004), especially in the health care sector (Braa et al. 2004). Heeks (2002) argues that the percentage of ICT projects which end up as

"partial" or "complete" failures is significant, and arise from "design-reality" gaps between the existing situation and 'where the system promises to take us to' (Heeks 2002). Heeks et al. (1999) identify seven dimensions to these gaps (ITPOSMO - Information, Technology, Processes, Objectives and Values, Staffing and Skills, Management and Structures, and Other Resources). They go on to argue that the relative success or failure of the ICT initiative depends on the size of this existing gap, which needs to be addressed not only through a focus on technical solutions, but also with the interconnected social conditions. The analytical focus taken in this thesis to try to understand and address these socio-technical gaps is through strengthening the communication practices and sense of social identity of the health staff.

1.2.3. Conceptual framework of the study: counter networks, communication practices and social identity

Counter networks is a concept used in this thesis to help better contextualize the health information systems implementation being studied, and to emphasize the action research orientation of the study. The notion of a "counter network" is adopted to conceptualize the relationships between health staff, their practices - both around providing care and conducting routine administrative tasks of data processing. These activities are shaped by the artifacts in use, physical conditions (for example, geographical distance) and administrative structures (for example, the hierarchical relationship between the national level and district levels). This network shapes data flows within and between health facilities and levels. The "counter" prefix to the network helps to emphasize the adverse infrastructure conditions (of people, financial resources, and technical and physical facilities) that exist in remote and disadvantaged areas like the rural PHC, and the resulting complexities in making them become active members of the so-called "network society" (Castells 1996). However, as is argued later in this thesis that these adverse conditions also contribute to create a potential for change in the existing situation of marginalization.

The analytical focus of this thesis is on the communication practices of the health staff as they engage in the collection, aggregation, reporting and transmission of data in their

respective facilities, and across the different levels of the health administration hierarchy. The focus on communication practices includes the following aspects:

- Analysis of the socio-technical heterogeneous network comprised of the social relationships between staff and physical arrangements such as the room in which they sit, the distance between one facility and the other, and the artifacts in use; and,

- The relationship between the levels (sub-district, districts, province and national) of the health administration hierarchy and between the health staff and the community.

These communication practices are embedded in a socio-historic and political context comprised of the bureaucratic structures of the health department and the historical relationship that exists between the staff and the larger community. A member of the health staff is situated between these two groups of the department and the community, and is engaged with the everyday activities of both the medical and administrative, shaping what is called "social identity". Social identity is thus another important analytical focus of this thesis, because as Sen (1999b, p. 13) argues, it helps to define both how choices are *delineated* (why one choice is preferred over another) and *perceived* (what are the meanings that these choices hold). This focus on social identity thus helps to understand the choices health staff make and the reasons for these choices especially when computer-based health information systems enters their social world. Choices made are both shaped and reflected through the social identity of the staff, and their everyday communication practices.

The introduction of computer-based health information systems has implications on the communication practices of the health staff with respect to how health data is collected, shared, analyzed, and transmitted across departments and facilities. For example, the use of the computer based health information systems would involve entering all the data in one entry form, implying a different practice from before when the health staff needed to communicate and physically interact with each other to collect the different pieces of data and put them together. While computer-based systems provide the potential to strengthen the informational culture and capability of the PHC sector, they also make the existing culture vulnerable. The stance taken in this thesis is that, these are positive (and also

negative) elements in the existing information culture, and the challenge is to blend the best of the "old" with the new (computer-based health information systems) to try and develop effective implementation approaches.

In summary, the three important analytical elements of this thesis include counter networks, communication practices, and social identity. The analysis of their inter-relationships, it is argued in this thesis, helps to understand the dynamics surrounding the introduction of computer-based health information systems. The research questions which thus emerge from this analytical focus are now presented.

1.3. Research questions

The following research questions are defined as being central to the thesis:

i. What are the characteristics of a "counter network" in relation to the PHC sector of a disadvantaged remote area, for example in Mozambique?

ii. What are the characteristics of the communication practices within and between different levels of the health structure – how are they constituted, expressed and shaped?

iii. How does an understanding of the relationship between communication practices and social identity provide insights into the dynamics of health information systems implementation?

iv. How can a context-sensitive understanding of communication practices and social identity enable the development of more effective practical health information systems introduction strategies?

These research questions are addressed through longitudinal case studies in two health districts of Mozambique. The research approach adopted in the case study is now briefly described.

1.4. Research approach

The philosophical assumptions underlying this study as based on an interpretive research approach which assumes that reality is socially constructed, and knowledge of it is accessed through studying processes around language and shared meanings (Walsham 1993). The interpretive research approach emphasizes the role of action and the agent, and the dynamics by which they mutually constitute and are constituted (Walsham 1995a). The focus of this thesis is on understanding the mutual relationship between communication practices and social identity of the health staff within the context of the PHC sector of Mozambique. This research is situated within the HISP[2] – Health Information System Program – a global research and development network on health information systems by the University of Oslo in Norway, which started in South Africa in 1994. In Mozambique, HISP was initiated through the establishment of an interdisciplinary team in 1998 of which I was a member. The HISP project is based at the Department of Mathematics and Informatics and at the Medical Faculty of the Eduardo Mondlane University. As member of the HISP team, I had opportunities to work closely in the health districts, and make detailed observations of the work setting. Within the HISP action research framework, I visited several health districts over time and participated in training seminars, formal and informal meetings, and conducted interviews with various actors involved in the health sector. This exposure also helped to develop a deeper understanding of the problem domain, and to make the research questions more focused.

Specifically, for the purpose of this study, I selected two health districts, Cuamba and Xai-Xai, in the Niassa and Gaza provinces respectively. Cuamba, currently a HISP pilot site, serves as a training site for the medical students of Eduardo Mondlane University. Focusing on these districts, I performed an in-depth analysis of the practices surrounding the flow of routine information within and between health facilities. Simultaneously, as

[2] HISP aims to support health management information and decentralization structures in disadvantaged areas in developing countries including Mozambique and includes the introduction of computer-based health information systems to empower local users to have greater control of their own health information Braa, J., E. Monteiro and S. Sahay (2004) "Networks of Action", In *MIS Quarterly* **28**(3): 1-26.

an action researcher I have been involved in various interventions around developing and introducing new computer-based health information systems. Through the use of an interpretive lens, I have attempted to analyze some key processes around the introduction of computer-based health information systems, the complexity of how health staff make sense of the health information systems, and how these shape communication practices surrounding the flows of health information systems, and with it the introduction of new computer-based health information systems.

1.5. Expected contributions of the research

The study aims to contribute to both the theoretical domain of information systems implementation research, and to develop practical implications useful for managers engaged in implementing health information systems in developing countries, specifically in the Mozambican context.

1.5.1. Theoretical

The thesis primarily contributes to the domain of information systems and health information systems implementation research informed by a social systems perspective. Two specific contributions envisaged are:

- Development of a theoretical perspective to analyze the socio-technical challenges associated with the introduction of computer-based health information systems within a developing country context; and,
- Emphasizing the relationship between communication practices and social identity in shaping health information systems introduction in such contexts.

1.5.2. Practical

Two practical contributions emerging from this research are the following:

- Development of practical guidelines on health information systems introduction that are sensitive to the social context; and,
- Development of guidelines on how communication practices can be strengthened

so as to improve the sharing of resources and experience between health staff.

1.6. Structure of the thesis

The thesis is organized in six chapters. In this introduction chapter, I have presented the research topic, problem domain, research questions, expected contributions and the structure of the thesis. A background of the socio-historic and political context of Mozambique is provided in chapter two which situates the study within its broader national context. I then present in chapter three the theoretical framework to help analyze the interrelationship between communication practices, social identity, counter networks and health information systems introduction. In chapter four, I summarize the research approach adopted for the collection and analysis of empirical data, grounded in an interpretative tradition. In chapter five, I provide a brief overview of the research findings from the five research papers included in this thesis. The papers themselves are included as appendixes. The contributions, both theoretical and practical, of the research are presented in chapter six followed by some brief concluding remarks of the research.

CHAPTER TWO

2. EMPIRICAL SETTING: THE MOZAMBIQUE CONTEXT

In chapter one, I introduced the thesis, the research motivation, the research questions and the expected contributions. In this chapter, I provide some background information about Mozambique, which helps to describe the empirical setting of the study analyzed in this thesis. This contextual background also helps to understand some of the historically existing conditions of the health sector.

The study presented in this thesis is based on empirical research carried out in two health districts of Mozambique during the period of 2000-2003. Mozambique, like many others developing countries, is experiencing multiple problems ranging from poor living conditions, inefficient provision of health care services and the prevalence of absolute poverty (more 60 percent of the population are living in grinding absolute poverty and have limited access to safe drinking water and sanitation) (Governo de Moçambique 2000) to name just a few of the existing problems. Processes of social development are largely inequitable, especially in the health sector, and the relatively positive changes being experienced in the cities are not yet being felt by a majority of the population, especially those living in rural areas.

The chapter is organized in to three broader sections. In the first section, the socio-historic and political context is described to provide an overall understanding of the background of Mozambique. Section two is divided into four subsections within which I outline how this contextual background shapes the health sector. In the last section, I describe the current status within the health sector in terms of existing systems, opportunities and challenges in introducing computer-based health information systems.

2.1. Socio-historic and political context

Mozambique is located in the south-eastern cost of Africa (see Figure 2.1) and according to the 1997 census had a population of 15 740 000 (INE 1999), with over 70% living in rural areas and with an illiteracy rate above 60% amongst the population. The country is

administratively divided into eleven provinces including the capital of the country, Maputo City, which also has the status of a province. Each province is divided into districts which further divided into administrative posts. In total, Mozambique has 128 districts, 33 municipalities, 68 towns and 387 administrative posts.

According to the World Bank classification of countries based on Gross National Income (GNI) per capita, Mozambique is ranked as a developing, low-income economy and in debt, with a total Gross National Product (GNP) being estimated in 1997 at US$2.4 billions, and the per capita GNP at US$143 (HDR 2000). Currently, the Gross Domestic Product (GDP) per capita is estimated at US$195 (HDR 2004). The government is still heavily dependent on external support, currently constituting about 17% of the overall GDP.

The history of Mozambique can be traced back between the first and fourth centuries AD, when Bantu-speaking people migrated from West Africa to central and southern Africa.

Figure 2.1: Map of Mozambique
(Source: United Nations, Department of Public Information Cartographic Section,1998)

The years between 1498 - 1975 represent the colonization period which commenced with the fortuitous arrival of the Portuguese navigator Vasco da Gama to the Mozambican coast in 1498 on his way to India. Since then, Portugal maintained (until 1975) her colonial presence in Mozambique, mainly in the islands and the coast of the Northern provinces. It was during this period that Portugal established a feudal system of ownership, which can be said to have enhanced the system of forced labour (known as "Chibalo"), for Mozambicans.

During the late 1950s, in response to the colonial occupation of many African countries, a resistance form of African leadership started to emerge and a number of national movements started to grow. In 1962 in Dar-Es-Salaam (Tanzania), the FRELIMO[3] party was formed by Eduardo Mondlane and other Mozambicans, who to escape colonial oppression, moved to neighboring countries in order to formulate the struggle against the Portuguese occupation. Since 1964, Mozambique became engaged in an armed campaign against the occupation of the Portuguese colonial powers, ultimately resulting in the signing of the historical Lusaka Agreement (Acordo de Lusaka) in September 1974. This allowed for a transfer of power from the Portuguese colonial government to FRELIMO on the 25th of June 1975.

Post-independence, many of the Portuguese population, along with local skilled and professional staff, started to leave the country. This exodus to Portugal (accompanied by sabotage of existing physical and social infrastructure) to neighboring countries such as South Africa and the then Rhodesia, had an adverse effect on the country's economy. For example, only 5 academic staff remained in the only university in the country (Universidade Eduardo Mondlane 1989).

In order to address these resulting constraints in multiple spheres of development post-independence, the government started to lay out and institutionalize radical reforms in the health and education systems (Mwaluko et al. 1996), based on centralized planning and grounded in socialist principles. With it, private schools were closed, businesses nationalized, and collective farms organized. Together with this, the new government

[3] FRELIMO – Mozambican Liberation Front.

launched an ambitious program in the health sector (Ministério da Saúde 1979), and the PHC approach was adopted as a basic strategy. The Sistema Nacional de Saúde (SNS - National Health System) was created to expand health care services to the entire population, especially to those living in rural areas. Within this strategy, a range of efforts for the development of health services to all citizens are still ongoing, including increasing levels of equity in health care (Ministério da Saúde 2001).

However, with people still celebrating the joy of independence, civil war began in the early 1980s between FRELIMO and RENAMO[4]. The war undermined much of the ongoing reforms efforts which the then current government was undertaking. During this period, the country's infrastructure, including the health facilities and schools, were consistently targeted. For example, between 1981 and 1988, 291 health units were destroyed and a further 687 looted and temporarily closed (Lindelow 2002). By the end of the war it was estimated that almost half of the 1,195 health units that existed in 1985 remained closed (Van Diesen 1999). The civil war systematically destroyed for nearly two decades the physical and communication infrastructure in the country, including telephone lines, and roads. Until 1992, the country knew no peace, up to 1 million Mozambicans died from fighting and famine, and about 4 million people were forced to flee their homes. This desperate socio-economic status resulting from the civil war significantly contributed to the problem of poverty and the general ruin of the health status of the population.

In as attempt to counter this prevailing situation of poverty, inequity, and war, the government implemented the Economic Recovery Program in various sectors, including health. Mozambique joined the International Monetary Fund (IMF) in 1984, and from 1987 various policy reforms were initiated to promote economic recovery. However, these efforts were complex to implement because of the intensification of the war that was affecting most parts of the country, especially in the rural areas, which led to increasing the economic difficulties for vulnerable groups (Noormahomed and Segall 1994). The civil war seriously affected socio-economic development processes leading to inequity in growth, the effects of which are still being felt today. In addition, the country

[4] RENAMO – National Mozambican Resistance.

was left with a legacy of landmines resulting in a large number of people with amputations who had inadequate health facilities to take care of them.

After various rounds of negotiations between FRELIMO and RENAMO, the next phase of the country's history can be seen to start after the signing of the peace agreement in 1992, which marked an end to the civil war (Awepa 1992). This agreement led to free and peaceful elections in 1994. With the election of the new government, the country started to accelerate the implementation of the Economic Recovery Program to meet the enormous challenge of rebuilding its society and economy. Nevertheless these various efforts, in the post-conflict years, the country has repeatedly been ranked as one of the poorest countries in the world (HDR 1999). Unfortunately, due to the historical legacy of colonial rule and the civil war, the achievements of the PHC sector have been considerably below expectations, resulting in extremely poor health and low social indicators as compared with other sub-Saharan African countries. A comparative summary of these indicators is provided in Table 2.1 below.

Table 2.1: Indicators of Mozambique compared with sub-Saharan African countries.

Indicator	Mozambique	Malawi	Zambia	Zimbabwe	Sub-Saharan African
GDP (2002)	195	177	361	639	n.a.
Life expectancy at birth (years) 2002	38.5	37.8	32.7	33.9	46.3
Infant mortality rate (per 1,000 births) 2002	125	114	108	76	108
Mortality rate under 5 years (per 1,000 live births) 2002	197	183	192	123	178
Maternal mortality rate (per 100,000 live births)	1100	1100	650	700	n.a.
Low birth weight (LBW) (%) 1995-2002	26	25	28	13	n.a.
Telephone mainlines (per 1,000 people) 2002	5	7	8	25	n.a.
Internet users (per 1,000) 2002	2.7	2.6	4.8	43	n.a.

(Source: Human Development Report 2004)

Despite these problems, and on a more positive note, the health indicators of Mozambique show an increasing trend since the peace agreement. However, they still rank amongst the lowest in the sub-Saharan African countries. Given the higher GNP of most sub-Saharan countries as compared to the Mozambique, these inequalities are expected to continue.

Nevertheless, the Ministry of Health have produced various guideline documents with the purpose of improving the lives of its citizens, including the poorest and most vulnerable, through a series of policy initiatives (Pavignani and Colombo 2001). Some of these initiatives include the adoption of the Strategic Plan for the Health Sector (PESS[5]) (Ministério da Saúde 2001) in 2001, to help guide the reconstruction and development of the health sector, and the Strategic Plan for Absolute Poverty Reduction (PARPA[6]) (Conselho de Ministros 2001) to support the general reconstruction and national development of the health sector. While PARPA consigns objectives, targets and strategies for the national development policy, PESS defines specific objectives and targets for the health sector (MPF and MISAU 2004a).

2.2. The contextual shaping of the health sector

In this section, I briefly discuss some of the influences the context (described in the previous section) on the health sector. Three such influences are described: i) the spread of facilities; ii) investments in the health sector; and iii) the human resources issue.

2.2.1. The spread of facilities

During the colonial period, the majority of the Mozambican population was socially and economically excluded and limited efforts were made towards their social development, particularly for those in the rural areas. For example, the health system inherited post-independence was primarily oriented towards urban areas, and the health status of the population was very poor due to the historical neglect of it by the Portuguese colonial regime.

[5] Plano Estratégico para o Sector de Saúde. The key principles of PESS are efficiency and equity, flexibility and diversification, partnership and community participation, transparency and accountability, and integration and coordination: Dgedge, M., J. Chabot, J. Koot, A. Mussa and L. Zuidberg (2003) Second Joint Evaluation of Health Sector Performance in Mozambique During 2002. Ministry of Health. Maputo.

[6] Plano de Acção da Redução da Pobreza Absoluta. A comprehensive framework conceived as an instrument within the public planning system that makes the government's five-years program operational. The key objective of PARPA is the reduction of absolute poverty and the main areas of focus are: education, health, agriculture and rural development, infrastructure, good governance and macroeconomic and financial management; Conselho de Ministros (2001) Plano de Acção da Redução da Pobreza Absoluta. Maputo, Moçambique.

The adopted strategies post-independence have contributed to the rapid expansion of the number of PHC facilities (from 326 in 1975 to 1195 in 1985) and to the general increase in the size of the trained health workforce (nearly 10,000 health workers were hired between 1975 - 1990) (Van Diesen 1999). This expansion was possible through a reclassification and upgrading of the existing facilities and the building of new facilities, which was intended to reduce the inequalities between the urban and rural areas and particularly to strengthen the historically neglected areas related to health promotion, prevention, and the countering of endemic diseases. This growth of facilities and implementation of services in various sectors, especially within health and education, was however seriously hampered by the shortage of professional staff like doctors and teachers due to the post-independence exodus of skilled workers and the inadequate remaining local capacity. This seriously magnified the pressure on the health care delivery system, given the already existing shortage of health staff.

Currently the health sector of Mozambique is characterized by an acute shortage of qualified staff and fragmentation of the health system, with only a marginal percentage of the population having access to effective health care. In addition, health facilities located in different areas serve varying amount of the population. This imbalance in facilities and infrastructure is being steadily reduced through the building of new facilities especially in rural areas. For example, according to the Health Sector Recovery Program launched by the government in 1996, by 2002 Mozambique should have had 1,450 first-level health units (health centers and health posts) and large health centers would have had clinical laboratories (EDI 1996).

Despite unfavorable existing working conditions, a shortage of well-trained staff, and poor staff salaries in the health sector, now, an estimated 50% of the population is reported to have access to the health system.

2.2.2 Investments in the health sector

After independence, the efforts from the government were reflected in the growth of health sector expenditures between 1975 and 1981 from 8.7 to 10.7% of total government spending (MPF and MISAU 2004a). In general terms, the external financing of the health

sector has increased in comparative terms from 9% in 1983 to approximately 60% in early 90's. A more recent survey carried out in the health sector reported that the total expenditure in health increased from US$4.6 per capita in 1997 to US$7.5 in 2000, reflecting a real growth of about 65% in 3 years. This growth is also due to an increase in allocation in the state health budget from 7.7% in 1997 to 8.8% in 2000. Government projections point to an increase in health expenditure to US$10.7 per capita in 2002 to US$15.9 in 2005 and to US$21.3 per capita in 2010 (MPF and MISAU 2004a), where a significant proportion of these expenditures (about 68%) is funded by international cooperation aid such as international institutions such as World Bank, African Development Bank, European Union, and international NGOs (Non-Government Organizations) like the Bill and Melinda Gates Foundation. Currently, nearly 50% of government spending and 75% of public investment including in health is being financed by external aid (Falck et al. 2003).

2.2.3 Human resources issue

Nationally, the health system is comprised of a total of about 1,200 health facilities which employ about 16,248 people - 10,141 health technicians (all levels) of which about 435 are physicians (Jamisse et al. 2004) (being most located in Maputo) and about 6,200 administrative staff (non-medical personnel) (MPF and MISAU 2004). While the National Health System employs a higher proportion of elementary and basic trained personnel, the percentage of university trained personnel is very low, especially in the district and general hospitals. At the district level, there is a lack of personnel trained in management and administration. In general, the National Health System has been struggling today to fill the gaps caused by the departure of qualified technicians, a problem magnified by the relatively fast growth of health facilities, especially in the rural areas. However, questions still remain whether the health facilities are in fact properly staffed, and if the health services that people are actually accessing are of the expected quality. Under current reform efforts and conditions of relatively increased stability and economic growth, the government is seeking to further strengthen and expand the provision and management of the health services.

In summary, the socio-historic and political context of Mozambique has had significant influences on the health sector. These influences are important to understand the challenges in introducing computer-based health information systems. For example, the colonial rule neglected the rural areas with respect to health care, and this neglect was further reinforced by the civil war which led to the destruction of health facilities. While the government was simultaneously building new facilities, they had to deal with this stark legacy of inadequate infrastructure.

Same in the case with the status of human resources in the health care sector. The exodus at the end of the colonial rule left very few physicians and trained staff. This shortage was particularly magnified in the rural areas. These shortages are significantly influence the current computerization efforts as will be described in the course of this thesis. The high foreign investment in the health sector makes Mozambique very aid dependent, and consequently subject to donor influences. These influences have contributed to a multiplicity of donor supported information systems, which have implications on the introduction of new initiatives like HISP.

2.3. The current status

2.3.1. Health Care in Mozambique

Mozambique is promoting a combination of preventive/promotive services through three major health providers within the National Health System: the public, private profit-making, and private non-profit-making.

- *The public sector* is responsible for the management of more than 95% of the health infrastructure within the country, and currently is the major health services provider to the population;

- *The private profit-making sector* is growing gradually, especially in the large towns and cities of the country. However, this growth is largely dependent on an increase in household income. Currently, the majority of the population cannot afford to pay for services charged in the private clinics, and the system of health insurance is largely non-existent; and,

- *The private non-profit-making* sector is mainly comprised of NGOs and religious groups in agreement with the Ministry of Health (Ministério da Saúde 2001). The role of this sector is to implement community health care programs of prevention, disease control, and for providing education and information. However, this NGO – government partnership is still rather immature, especially in the most disadvantaged areas.

According to PESS, there are some other health service providers such as people dealing with non-allopathic cures (including traditional medicine, and herbs) and Community Health Agents (ACSs). Unfortunately, these agents are not officially included in the formal system, and data on the services provided by them, for example, assisted home births, are often excluded from the routine health information system. The ACS are offered incentives in the forms of products, such as sugar, soap and salt, in exchange for their services rather than of money. The number of ACSs in different districts is varied, for example during field work, I found that there were about 7 ACSs in Xai-Xai and 21 in Cuamba.

2.3.2. Levels of health care delivery and health information systems

In Mozambique, the delivery of health care in the public sector is organized into four levels:

i. *Primary*: This level includes health posts and health centers and provides health care to the majority of the population in peripheral areas. It serves as the entry point for patients into the health system, and provides basic health care. There have been some positive experiences in the participation and involvement of community groups and NGOs at this level.

ii. *Secondary:* This level corresponds to the rural and general hospitals which include the provision of specialized health services and health care support to all health facilities within the district. They supervise the functioning of the primary level, help coordinate activities between the Ministry of Health and other health care providing organizations within the district, and provide

health care to referral patients from primary levels. The specialized services provided include emergency care and surgeries such as non-complex obstetric and trauma interventions. The number of health facilities (health centers and health posts) in each district varies from 5 to 15. Not all districts have a rural hospital, and these districts are served only by the health centers. Due to the very small number of medical doctors in the country, most districts are served by only one medical doctor**.**

iii. *Tertiary*: The tertiary level corresponds to the provincial hospitals and serves as the second referral point after the secondary level. Each province has a provincial hospital which is the advanced health entity in the region and provides curative services including surgeries. This level provides support, supervision and is responsible for the coordination of all health activities in the province. The provincial hospital is the most well-equipped health facility in the province and is comprised of staff specialists who provide complex services such as internal medicine, general surgeries, pediatrics, obstetrics, genecology, dentistry, and ophthalmology amongst others. The nursing training institutes and the provincial health directorate which are responsible to provide broader support in terms of planning and evaluation of activities in the province, including the collection of statistical and epidemiological data to be sent to the national level, are also located within this level.

iv. *Quaternary:* This level corresponds to central and specialized hospitals. There are three central hospitals (Nampula, Beira and Maputo) in the country distributed geographically around the three regions, North, Center and South respectively. These are the higher level health facilities, with the Maputo Central hospital being the best equipped and serving as the main referral health facility in Mozambique. The central hospitals provide specialized services like neurosurgery, orthopedic, plastic surgery and cardio-vascular surgery amongst the more complex treatments. Patients who cannot be treated here and have the financial resources, often go abroad, mainly to South Africa, to receive health care. The quaternary level is also responsible for

planning, programming, administration and evaluating the national health programs based on the analysis of epidemiological, demographic and health statistical data.

2.3.3. Structure of the Health Information Systems

The Ministry of Health is divided in to four directorates: the National Health Directorate, the Human Resources Directorate, the Administrative and Management Directorate and the Planning and Cooperation Directorate. Within the Planning and Cooperation Directorate there are three departments: Cooperation, Planning, and Health Information. The Health Information Department is in charge of the health information systems, which were instituted in 1982 by the Ministry of Health with technical support from the WHO.

Similar to the health care provision, the health information system of Mozambique is organized into four levels (health posts/health centers, district, province and national), and is designed to report on activities of the various health programs such as immunization, family planning, drug distribution and other planning and management activities at all levels (Gomes and Johnson 1994). Data are first collected at the clinics and aggregated at the district health offices, where they are transmitted to the provincial, directorate and then to the national levels.

Apart from providing PHC services, the health posts and health centers are responsible for the collection of health data in various forms and its transmission to the next level of the district. At the health posts and health centers, data related to a patient is first entered in books and tick registers. On a monthly and weekly basis, these figures are summarized and sent to district health offices, indicating the number of patients seen in a particular clinic classified by specific diseases. The staff involved in this process of health data transactions are mainly nurses or servants with limited or no formal medical training.

Within each district, there is a team of two or three people comprising the Nucleus of Statistics and Planning (NEP), who are responsible for the health information systems. This team is responsible for collection, collation, aggregation, analysis and transmission of health data received from all health facilities including data regarding the services, to

the province. The health staff in charge of the health information system are mainly nurses with elementary, basic or mid-level[7] medical training.

On a monthly (and weekly for epidemiological information) basis, the district office receives reports[8] from clinics with statistics of each health program which they then aggregate into consolidated reports and send to the province. While the health information system in the clinics and the district is paper-based, at the province it is computerized, i.e., the data received from the districts is entered into their respective provincial computer-based systems relating to infectious diseases (called BES – Boletim Epidemiológico Semanal), routine health (called SIS – Sistema de Informação para a Saúde), and monitoring and planning (SIMP – Sistema de Integrado de Monitorização e Planificação). These systems require data to be copied onto floppy or zip disks to be sent to the national level. On average, each province has more than three computers, while most of districts have not yet seen their first computer (Braa et al. 2001).

Since 1982, each health program had their separate reporting information systems, especially at the province and national levels. In order to simplify and integrate the existing multiple information systems the health information system was revised in 1989. The desire to create integrated and decentralized National health information systems has not yet been accomplished and data still tends to flow from the lower to the higher levels without being integrated into a common national database. Most health programs continue to have their standalone system including data sets and reports (Braa et al. 2001). For example, routine data from tuberculosis, malaria and HIV/AIDS are not coordinated and their reporting structures are outside the Health Information Department (Chilundo and Aanestad 2003). Within the existing context of reforms, a number of initiatives are currently ongoing to strengthen the health information system and address the challenges of fragmentation and lack of analysis. The Health Information System Program (HISP), the focus of this thesis, is one of these ongoing initiatives.

2.4. ICT status: A historical perspective in Mozambique

[7] Mid-level refers to completion of "high school" (12 years). Basic refers to 10 years of education, while elementary refers to 7 years of education completed.
[8] Forms containing total cases seen in each health facility aggregated by specific health program. For example, form A03 contains totals for each activity of Mother and Child program.

Although, ICTs are regarded as new in most developing countries, experiences of computing devices used in Mozambique can be traced back to the colonial period (since the 1940s) when some leading companies used adding and accounting machines as well as mechanical tabulators for statistical purposes related to transit trade. The first computer was installed in a tobacco company in 1964-65 (Kluzer 1993, p. 48)[9].

Efforts to establish and deploy ICTs in post-independence Mozambique led to the formation of the data processing centre (CPD – *Centro de Processamento de Dados*) in 1977, which aimed to serve the railways company and some other organizations. However, these efforts were undermined when most of the skilled personnel, including computer experts, left the country post-independence. This exodus contributed to the closure of major computer companies, including *Mecanodex* and *ICL*. The closure of these companies and the departure of the computer experts had a negative impact on the ICT sector in general, for example, the companies which owned ICL's equipment were left without any support and maintenance (Kluzer 1993). Notwithstanding these problems, the CPD played an important role in developing local capacity by training most of its internal staff, and slowly, after 1980 other new small scale computer centres were established in other provinces of the country. This trend has continued in contemporary times. For example, Macome (2003) reports on two cases: the establishment of an IT department within the public company EDM – Electricidade de Moçambique (Electricity Company) in the late eighties to computerize the billing systems, and one in BM – Banco de Moçambique (Bank of Mozambique) in 1994 to automate various banking transactions (Macome 2003).

Experiences in the implementation of ICTs are also found in the telecenters located in the districts of Manhiça and Namaacha in Maputo province (Macome 2003). In 1999, the Informatics Center of the Eduardo Mondlane University (CIUEM) set up two telecenters with support from the International Development Research Centre (IDRC) in Canada, and plan to further expand to other rural areas. These telecenters provide a variety of services such as Internet access, email, word processing, photocopying, scanning, fax,

[9] Kluzer in his study of diffusion of computers in Mozambique gives a historical description and account of the main factors influencing the process of introduction of ICTs.

telephone, television and video viewing, libraries and training. The objectives of these telecenters are to enable the access and use of information technology in rural areas, to help reduce the existing regional imbalances in access and to develop the capacity to use ICTs effectively. Although various constraining factors related to sustainability, infrastructure, staff, policy and politics were identified, the telecenters were in general seen as a positive initiative and a useful way forward. Macome (2003) has argued:

> Based on the information gathered … it can be stated that the initiative to set up Telecenters in Mozambique has responded to the desires of the rural population through the use of new information and communication technologies. This has contributed to the success of activities undertaken in the Manhiça and Namaacha districts, since some services were introduced in these districts for the first time through the Telecenters (Macome 2003).

The positive evaluation of the first two telecenters has led to an expansion and currently there are at least eight such telecenters in Mozambique (CIUEM 2004).

In 1999, a Commission was mandated by the government to design a national policy of informatics. This Commission comprised of various groups of people representing the broader society, for example university researchers and people from the private sector. Through this Commission, a national survey (funded by IDRC and the government) was conducted in 2000 of 700 companies in order to analyze the state of technology development (including the use of ICTs). The results of the survey indicated an increasing proliferation of ICTs nationally, but failed to highlight the inequalities in their distribution, especially between urban and rural areas. Despite a relative proliferation of computers both in the workplace and home, access still remains limited due to the high costs involved. Macome (2003) highlights the shortage of ICT professionals countrywide and argues: 'this tremendous shortage emphasizes that the ICT skills shortage has been and will continue to be one of the most serious challenges to the process of adoption and use of ICT within the country, and in particular, in public sector organizations' (p. 30).

Nearly 50% of the ICTs and technically skilled manpower are located in Maputo (Comissão Nacional de Política de Informática 2001), leaving the rest of the country in a

relative state of exclusion. This inequality in distribution of infrastructure and qualified people magnifies the challenge to broaden initiatives of ICT implementation in the country.

The ICT policy approved by the government in 2000 outlines, as a key objective, the integration of various national ICT initiatives to more coherently support overall national development processes and to promote cross-sectoral integration (Comissão Nacional de Política de Informática 2001). This integration is expected to contribute to the reduction of absolute poverty, improve the living conditions of the Mozambicans, and increase citizens' access to the benefits of global knowledge. In addition, in line with this policy, attempts are also being made to integrate different developmental initiatives in various sectors such as health and education, and thus address prior problems arising from uncoordinated efforts in the adoption of ICTs (Conselho de Ministros 2000). However, how this policy will be practically implemented remains an open empirical question. I now briefly discuss the status of ICT in the health sector, which is the focus of this research.

2.5. ICT in the health sector

Within the ICT policy of Mozambique, the health sector is defined as one of the priority areas for ICT applications. ICTs are seen to play a central role in the processes of strengthening the informational basis of decisions related to health care delivery and disease control (Ministério da Saúde 2001). Policy specifically addresses the role of ICTs in improving the efficiency of health systems through the processing and analysis of routine health data and its reporting to higher levels of the health administration hierarchy. Prior to 1992, the health information system was paper-based, covering all levels (district, province and national) and included multiple health programs such as Mother and Child Health, family planning, immunization, Malaria and Tuberculosis. Some of these vertical programs (such as Tuberculosis and Malaria) were autonomous and collected data based on their individual needs rather than that of the overall health services (Braa et al. 2001). After 1992, the Ministry of Health revised the health information systems with the aim to integrate most of the existing health programs and

since then computer-based initiatives have been ongoing in the health sector in Mozambique. These computerization initiatives led to a reduction in data collecting forms (from 60 to 12) and the installation of a computer-based database (SISprog) in all provincial health offices and at the national level in 1992 (Braa et al. 2001).

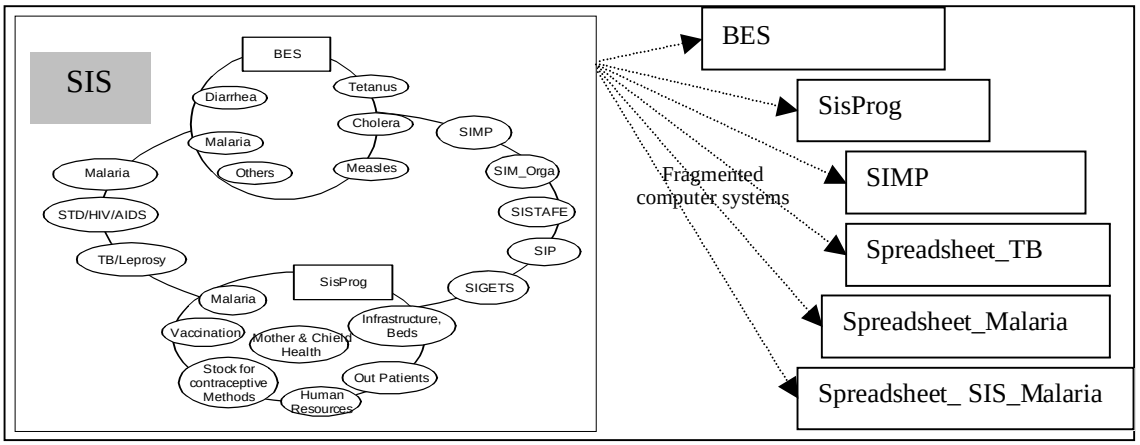

Figure 2.2: SIS and associated computer subsystems.
(Source: Kimaro and Nhampossa (2005))

Contrary to the objectives for integration, however, SISprog did not support all existing health programs. This situation led to the generation of several computerized systems from other health programs in different platforms, which were supported by different international donors, especially at the provincial and national levels. Kimaro and Nhampossa (2005) have documented the resulting "spaghetti" (see Figure 2.2) of the various existing health information systems operating in Mozambique, including BES[10], SIMP[11], SIS_Malaria[12], and others. As a result of this, the current data flows, within and across levels, are still not integrated in the SISprog. For example, data from the Malaria program is reported through three different computer applications - SISprog, Malaria vertical program, and BES - this creates a challenge for the integration of the various existing health information systems (Chilundo and Aanestad 2003).

Notwithstanding the existing complexities within the health information system, and similar to the strategy in other developing countries, the ongoing reform and

[10] BES refers to the weekly epidemiological bulletin, and is the system for supporting surveillance of a number of important infections diseases.
[11] SIMP refers to the integrated system for monitoring and planning. This system is currently being used at the provincial and at the central level to report on finance, personnel, infrastructures etc for monitoring and planning;
[12] SIS_Malaria is a health information system for Malaria program.

decentralization efforts in Mozambique are focusing on the health district as the informational and physical hub for the health information (Amonoo-Lartson et al. 1984; Lippeveld et al. 2000). These reform efforts provide political opportunities for new initiatives to strengthen the health information system and to help managers at various levels to conduct as analysis of the data they are collecting. It is within this context, the HISP efforts, which is the focus of this research, has been initiated. In this thesis, I discuss both the opportunities and the challenges for implementing HISP, especially by focusing on the communication practices of the micro-level and the social identity of the health staff.

In summary, the given background helps to situate the study in terms of its context, history, and current status of the health sector. In the next chapter, I describe the theoretical framework developed to aid such an analysis.

CHAPTER THREE

3. CONCEPTUAL FRAMEWORK

In this chapter, I discuss the underlying theoretical ideas which help to address the research questions posed in this thesis, and also to frame the contributions arising from the study which will be presented in chapter six. The theoretical basis of this thesis rests on three key conceptual ideas: counter networks; communication practices; and social identity. The underlying argument is that studying the inter-relationships between these three concepts helps to analyze the implementation of health information systems in a socially informed and context sensitive manner. While the idea of counter networks helps to emphasize the particularities of the context, communication practices elaborates on the micro-level activities of the health staff and its relation to health information systems. The notion of social identity emphasizes the different sets of social relationships within which health staff are embedded, and the aspects of power and practices that are inherent in these multiplicity of relationships. Taken together, these three concepts help to understand the social world of the health staff more generally, and including their relationship to the health information systems. The argument is that understanding this social world is important as it helps to analyze the relations of people and activities with the efforts to introduce computer-based health information systems. Introduction of new systems will tend to be seen by people to reconfigure their existing social world, which shapes their meaning and behavior towards the computerization efforts. The theoretical framework thus developed seeks to analyze the interaction between the social worlds of the health staff in the PHC sector (elaborated through these three concepts) and the efforts of the HISP action research initiative to introduce the computer-based health information systems.

In this chapter, firstly, I discuss each of the three concepts, how they relate to information systems research, and the manner in which I have appropriated them for my analysis. Secondly, I analyze the three concepts together, which represent my research framework, and discuss how they help to provide insights into the health information systems implementation process.

3.1. Counter Networks

Counter networks is a concept used in this thesis to help better contextualize the health information systems implementation being studied, and also to emphasize the action research orientation of the study. Context-based analysis is increasingly being recognized as being fundamental to understand information systems implementation (Orlikowski 1993; Walsham 1993). Walsham argues that information systems research has predominantly focused on analyzing the "*content of change*", implying a primary technical focus while deemphasizing aspects of "*context"* (Walsham 1993, p. 52). Similarly, Sahay and Robey (1996) have also argued that understanding the relationship between context and process helps to effectively analyze the integrated relationship of information systems with organizations (Sahay and Robey 1996).

Context-based approaches find their conceptual roots in a social systems approach which sees information systems as part of a heterogeneous socio-technical network of people, objects and procedures (Avison and Fitzgerald 1995; Heeks 1998). Within this perspective, health information systems are conceptualized as a set of tools and procedures that health programs apply to collect, process, transmit, and use data for monitoring, and control of diseases and the evaluation of health status of the community (Braa and Blobel 2003, p. 196). Health information systems thus emphasize aspects of humans, technologies, organizational procedures and their inter-linkages.

The usefulness of the social systems perspective is reflected in the increasing use of social theories in information systems research. In the 1980s, web models (Kling and Scacchi 1982; Kling 1987) were crucial in drawing attention to aspects related to social context, which were seen as pre-given to an implementation situation, for example, the existing tradition in the organization of using computers. Similar ideas were further developed by Pettigrew who distinguished between the "outer" (for example, the social conditions) and "inner" (for example, the organizational situation) contexts (Pettigrew 1987). While this thinking about context represented an improvement on the earlier "factor based" approaches grounded in a computer science tradition (Sahay and Walsham 1996), they were nevertheless limited and static in providing deeper insights into the

"process" of information systems implementation, and how this related to the social context within which the implementation is situated.

To the above end, structuration theory has been used by information systems researchers to understand this (context-process) linkage, crucial to the analysis of information systems in organizations (Walsham 1993, p. 60). Structuration theory (Giddens 1984) fundamentally emphasizes the duality of social structure and action, the inseparable linkage between them, and the processes through which human actions produce and reproduce structure (Jones and Karsten 2003). Lyytinen and Ngwenyama (1992) argue that "all social activity, including work processes, can be viewed as enabled and constrained by social structures that are produced and reproduced through human action" (Lyytinen and Ngwenyama 1992, p. 21). An empirical example of the application of structuration theory in information systems research is Sahay and Walsham's (1996) framework to analyze the social context, the process of implementing Geographical Information Systems (GIS) in India, and the inter-linkages between them. They emphasize two aspects of social context relating to government organizational structures and the scientific tradition, and relate these to the initiation, operationalization and continuation phases of the GIS implementation process.

The use of structuration theory in information systems research has also been subject to several critiques (Archer 1982; Barley 1986; Orlikowski 1993), especially of its relative neglect of technology. For Giddens, structure does not exist in material artifacts, such as technology, but in human memory traces and are seen to be enacted through social practices (Jones and Karsten 2003). Giddens and Pierson (1998) argue that 'technology does nothing, except as implicated in the actions of human beings' (Giddens and Pierson 1998, p. 82). Monteiro and Hanseth (1995) present the following critique of structuration theory's relative neglect of technology:

> Our principal objection to conceptualizations like (Orlikowski and Robey 1991; Orlikowski 1991; Orlikowski 1992; Walsham 1993) is that they are not fine-grained enough with respect to the technology to form an appropriate basis for understanding or to really inform design. (Monteiro and Hanseth 1995, p. 330).

In order to take "technology more seriously" and become more "specific about technology," in the last decade there has been an increasing use of Actor Network Theory (ANT) in information systems research. ANT sees information systems implementation configured within a complex socio-technical and heterogeneous network comprising of actors, institutional arrangements, textual descriptions, work practices and technical artifacts (Hanseth and Monteiro 1997). Research drawing upon ANT seeks to "examine more than just the technological system, or just the social system, or even the two side systems side by side; … but the phenomena that emerge when the two interact (Lee 2001, p. iii). Similarly, Hanseth et al. (2004), in their introduction to a special issue of ANT in the Information Technology and People journal emphasize the superiority of ANT over structuration theory in its analysis of technology (Hanseth et al. 2004, p. 117).

> The structuration theory approach has been picked up by a vast number of scholars and a wide range of studies have been carried out. These have given us many valuable insights into the social processes related to adoption and use of information systems. There is one aspect of these studies that is of crucial importance here. That relates to the role of technology in these studies as well as the theories they are based on. These go equally well (or more precisely, badly) for both structuration theory and institutionalism. The studies of information systems based on these theories do not address the role of technology in a proper way. This fact is largely a consequence of the fact these theories totally ignore technology. This makes ANT – and the technology studies part of the STS field – different. And in this respect ANT offers some unique and very important contributions to information systems.

In the special issue mentioned above, five exemplar papers were presented on ANT applications to different technologies and settings. For example: as a conceptual and methodological tool for development of research practice (Marres 2004); to show how the notion of "reliability" of health information is subject to negotiation (Adams and Berg 2004); in studying the concept of inclusion in multiple technological frames using a socio-technical approach (Allen 2004); as a basis for studying the evolution process of a complex technology (Faraj et al. 2004); and for a comparative use of ANT and escalation theory to analyze dysfunctional IT projects (Måhring et al. 2004).

ANT is also not free from criticism, a key one stemming from its assumption of according symmetry between the social and the technological in the actor-network (Walsham 1997, p. 469). Hanseth et al. (2004) counter this criticism by arguing that "this is an unfounded claim. It is true in the sense that ANT assumes everything to be an actor-network. And accordingly so are both human and technologies. But all networks are also different. So are different technological artifacts and so are different humans, at least in terms of roles they are playing in organizations and social life" (p. 118).

The idea of network as a metaphor is further developed by Manuel Castells (1996) in his celebrated analysis of social transformations taking place in contemporary society. Castells argues that contemporary organizations are seeking to develop informational networks, based on the twin axes of networking and technology. Such networks comprise of interconnected nodes with no centre, exemplified in global financial networks, production and consumption organized around the network enterprise, and the global criminal economy. He describes the power of such networks as follows:

> Because networks are extremely efficient organisations, they eliminate through competition, alternative structures, so their logic expands. Because they operate in a globally interconnected environment, they diffuse unevenly, throughout the planet, blurring institutional and cultural boundaries, and focussing exclusively on their instrumental performance. Networks are the carriers of globalization (Castells 2000, p. 110)

One important aspect of Castells' work, which is the source of inspiration for my use of this concept, is his focus on groups of people and regions (for example, in the developing world) who are being excluded from the network society. The state of marginalization and exclusion faced by these groups, Castells argues, can be changed by developing their informational capacities through linking the "local" and the "global": implying making the local situation visible to the global community, and thus strengthening the potential for advocacy for increased resources and focused intervention. This logic which Castells refers to as of "counter-domination" is exemplified by his description of the Zapatista movement in Mexico, where the Internet was used by the resistance movement to effectively link the local and global. Castells writes:

> Counter-domination operates through networks as well, as in the case of the environmental movement, or of counter-cultural movements, or human rights organizations, linking up the local and the global through the Internet (Castells 2000, p. 110).

Castells' discussion on the potential for counter-domination in networks is relevant to the context of research described in this thesis - the PHC sector. For example, in how the existing problems within the PHC sector in Mozambique, such as the lack of doctors, funds, and high disease burdens can be made more visible through the power of ICTs by potentially enabling the flow of information, knowledge, and other resources, across the network.

Castells has been criticized for being technologically deterministic (Kallinikos 2003), for deemphasizing the historical and social embeddedness of networks (ibid), and for not considering seriously enough the challenges in making networks work in practice (Barry 2001). For example, Barry sees Castells' argument to be primarily focused on how to get "technically plugged in," and ignoring the sustained, long-term, and intensive effort required to make things work in practice. As Barry argues quoting Castells:

> Castells' '*network state*' is a purely 'social' organization, devoid of any technological elements. Scratching below the surface, Castells' explanations about the exact constitution, dynamics and growth remains a bit vague … [The network] is a problematic metaphor… it may give little sense of unevenness of the fabric and the fissures, fractures and gaps that it contains and forms … [as] creating and maintaining a network requires work and repair (Barry 2001, p. 15, 101).

Kallinikos critiques the imprecise manner in which the concept of networks has been formulated and used, and argues that "compared to the strong social embeddedness of formal organizations and markets and their institutional and legal ties, networks emerge as nearly devoid of institutional and social anchoring." He argues that networks may not always be enablers of decentralized operations (Zuboff 1988), and on the contrary can also be deployed in ways that promote dependency and centralized operations (Kallinikos 2003). While the above critiques of networks are well taken, it can also be argued that various operations such as telemedicine would never have been possible in the first place

without the technology (of adequate bandwidth) being in place. As Castells answers to the criticism of his conceptualization as being technologically deterministic in the following way:

> Is this technological determinism? Yes and no. Fundamentally no, because I do not say (and no one in her right mind would say) that technology determines society … But, yes, if you want, in a particular sense: without new information technologies, networks could not harness complexity and expand globally. And I would generalize the argument: without new information/communication technologies, there could be no economic globalization, no network enterprise, no global media, no global communication, and no global criminal economy (Castells 2000, p. 11).

Drawing upon Castells, the notion of counter networks used in this thesis draws attention to the informational aspects of the network, and how this "informational capacity" can be strengthened. Developing the informational capacity through networking, Castells will argue, can support the efforts of hitherto marginalized regions and groups (in this research, the PHC sector) to become "included" in the "network society." Castells argues:

> The most critical distinction in this organizational logic is to be or not to be -- in the network. Be in the network, and you can share and, over time, increase your chances. Be out of the network, or become switched off, and your chances vanish since everything that counts is organized around a worldwide web of interacting networks (Castells 1999, p. 6).

The PHC sector of Mozambique is comprised of various interconnected sub-systems including health delivery levels (facility, district, province, national), and health programs (for example, TB, Malaria, HIV/AIDS etc). Within these different levels and programs, there are various activities performed (for example, providing health care and conducting administrative tasks), involving various departments, people, processes, resources, artifacts and organizational procedures and practices. In this thesis, the focus is primarily around the informational related activities being carried out by the health staff at the district and sub-district levels. These informational activities primarily relate to the production, transmission and use of the routine health information reports.

An existing "informational culture," implying how and why information is valued, characterizes the existing information related activities. This existing informational culture, embedded within the hierarchical and bureaucratic structure of the health department, sees the tasks of data collection, report production and their transmission as routine chores to be carried out because of the official requirements of the bureaucracy. This existing informational culture it is argued, potentially runs the risk of perpetuating the marginalized status of the PHC sector, as their problems (for example, the extremely high rates of maternal mortality in the community) remains largely local or are reported inadequately (in terms of both accuracy of the figures and the level of disaggregation at which they are presented – at the district rather than facility level) to the higher levels of the health administration hierarchy. In such conditions of inadequate information which keeps awareness about the deprived conditions largely invisible, the potential for advocating for and receiving improved resources and more specific interventions, remains extremely vulnerable.

Castells' ideas are inspiring to examine approaches to challenge these marginalized conditions through the potential and power of informational networks. This, it is argued, can be approached in two ways. Firstly, by strengthening the existing informational culture both by drawing upon the positive aspects of the existing, and blending it with elements of the "new" arising from the potential provided by the new ICTs. This strengthening thus involves improving the quality, both with respect to accuracy and scope, of the routine health reports, and developing the capacity of the health staff to both interpret (for example, understanding graphical representation of health data) and use the information to support their local and everyday activities (for example, demanding for more medicines). Secondly, strengthening the networking aspects of the information both horizontally (at same levels of facilities and districts for example) and vertically (across various hierarchical levels of the administration).

This networking creates the potential of increased visibility, the sharing of resources, and more focused interventions. However, as Byrne (2004) cautions, the availability of information is a necessary but not sufficient condition for change.

> There is also the need for commitment and support from the government and society for structural changes to be made … This information can assist in an improved knowledge base which can be used to put pressure on government and civil society to change the restrictive structures in which people live (Byrne 2004, p. 193).

To make authorities act on the available information, is largely a political challenge, one which is beyond the scope of this thesis.

Taken together, the strengthening of the informational culture and the networking aspects is described in this thesis to represent a form of "informational capacity" of the PHC sector. An important question which the thesis then seeks to discuss is "what and where are the resources to develop this informational capacity?" In trying to answer this question, I arrive at the core of this thesis on the challenges around the introduction of computer-based health information systems in poor and disadvantaged regions like Mozambique, and how these may be addressed.

In summary, the notion of counter networks as used in this thesis, helps to highlight the adversarial conditions (for example, poor roads and transport, high disease burden, inadequate ICT infrastructure and human resources) that inhibit disadvantaged entities like the PHC sector in Mozambique to join the network society. The counter networks idea also points to the potential that may exist in the existing network derived from historical, social, and political circumstances to "counter" the existing conditions that promote trajectories of marginalization. Of central importance in this regard is the development of the informational capacity, and reconfiguration of the information flows within a networking logic as proposed by Castells, as opposed to that defined by the existing structures of the bureaucracy favoring top-down flows.

An important aspect of developing this informational capacity concerns communication (Castells 1999), a concept which is now discussed.

3.2. Communication practices

Castells argues that a key element in the development of informational networks concerns the communication strategies adopted. For example, Castells attributes the success of the

Mexican Zapatista movement primarily to their communication strategy, describing it as the "first informational guerrilla movement" (Castells 1997). Castells argues:

> The Zapatistas' ability to communicate with the world, and with Mexican society, and to capture the imagination of people and of intellectuals, propelled a local, weak insurgent group to the forefront of world politics (p. 79).

The masks used by the rebels, in the photographs that were projected to the world media, also helped to develop global visibility for the movement. The charismatic role of Marcos, the leader of the movement, and the symbolic and also substantive meanings of the messages expressed through the internet helped to develop a worldwide network of solidarity groups that supported countering the repressive intentions of the Mexican government.

Joshi (1991), in the context of development in India, also argues for the important role of communication in reducing inequalities in the efforts to create an integrated society. He points to the potential that ICTs provide in helping to build national cultural identity, and enhance social benefits whilst taking a historical perspective. Joshi emphasizes the new possibilities that arise from the utilization of new ICTs can help to empower the disadvantaged and redress some of the uncaring trajectories that some developing countries are taking. Like Castells, arguing for the need to take advantage of the potential of new ICTs, he writes:

> In the same strain we can say that the choice before us in India is not between having or not having modern communication. It is between unplanned technology transfer from the affluent to the poor countries and innovative adaptation of modern communication to the conditions … of society in India (Joshi 1991, p. 122).

In diffusion research, Rogers explains how a new idea, product, or practice will be adopted by members of a given culture. Studying how innovation occurs, Rogers (1995) argues that it consists of four stages: invention, diffusion (or communication) through the social system, time and consequences. The information flows through networks. Rogers argues that the nature of networks and the roles opinion leaders play in them determine

the likelihood that the innovation will be adopted and how and why users adopt a new information medium, such as the Internet. Rogers argues:

> Diffusion is the "process by which an innovation is communicated through certain channels over a period of time among the members of a social system". An innovation is "an idea, practice, or object that is perceived to be new by an individual or other unit of adoption". "Communication is a process in which participants create and share information with one another to reach a mutual understanding" (Rogers, 1995).

While authors like Castells, Joshi and Rogers discuss the role of communication in more macro terms of countries and societies, the work of information systems researchers who have examined communication in the context of ICT and organizations is relevant in this thesis because of its focus on organizational settings. Some of the theoretical perspectives around communication developed in information systems research are now briefly discussed.

3.2.1. An overview of some theoretical perspectives on communication

ICTs fundamentally involve the construction of representations through various means such as models, reports, maps etc, and their transmission or communication to other people and also to machines (Chilundo and Sahay 2004). This use of ICTs for these purposes has led to communication historically being a significant topic of research for information systems scholars. In an influential study, Yates (1989) traced some of the historical trends in how communication served as a basis for managerial control in North American firms. Yates argues that communication is the means which managers use to coordinate activities in the office, particularly the handling of information (its storage and circulation). She analyses various technologies of written communication such as the typewriter, duplicating methods, and filling systems which represent interactions between people at various levels of a business organization (Yates 1989). Communication in and between organizations is a multi-faceted process, and influenced by aspects of distance, processes around the transfer of knowledge across time and space, and the identity of the people involved in the communication activities (Sahay et al. 2003).

Over the years, information systems researchers have articulated various perspectives on the study of communication. Given the vastness of this topic area, I present what I believe are some of these key perspectives, their origins, discuss what they are, and also present some of the critiques to those viewpoints. This discussion then helps to situate my notion of communication practices within these ongoing debates and perspectives. I discuss the following perspectives on communication:

i) Information processing perspective;

ii) Media richness perspective;

iii) Information as symbol and signal;

iv) Structurational perspective; and,

v) Communicative action.

These perspectives are now briefly discussed.

3.2.1.1. Information processing perspective

This perspective, associated with information theory and originally proposed by Shannon and Weaver in 1949, finds its origins in a computer science tradition. It articulates primarily a *technical* view of communication, in which meanings are seen to be contained in the message transmitted and the analytical focus is on how informational symbols affect the behavior of the receiver (Shannon and Weaver 1949). This perspective underlines the source-message/channel-receiver structure as the basic process of communication. Researchers, over the years, have used this model to study various aspects of communication such as perception, the engineering principles of transmission, the capability of people to communicate accurately or not because of their previous experiences, the various distortions that occur in the communication channels, and how can these be reduced.

Although, this information processing view is being influential in the study of communication in information systems, it has been criticized for separating the meaning from the context and reducing communication to a decontextualized question of transmitting and receiving messages from the sender to receiver. Cultural studies of

communication (for example, Hall 1996) have emphasized the importance of non-verbal communication and the role of the social context in conveying meaning, which have helped to raise questions about the adequacy of the information processing models. Despite its arguable limitations, this perspective is discussed because its underlying technical principles of communication are still seen present in existing research. For example, with respect to the Internet today, many argue that if the given connectivity and networks are in place, people over the globe will be able to freely communicate with each other (Sahay 2004).

In this thesis, the perspective taken is that while ICTs are indeed important in enabling communication, they are shaped by the social-political context in which they are embedded.

3.2.1.2. Media richness perspective

This approach was proposed by Daft and Lengel (1986) based on certain assumptions about organizations and information processing. A key feature of this approach was the argument that communication is not only about the transmission of information, but it is also related with the clarity of information. Daft and Lengel categorized the media richness theory based on two contingencies: *uncertainty* (Galbraith 1973) and *equivocality* (Weick 1979). Uncertainty underlies the assumption that managers in organizations work in conditions that lack sufficient information, and tasks can be better performed by acquiring relevant information. Equivocality reflects a state when available information is subject to conflicting interpretations, and accordingly influences their priorities of use (Daft and Lengel 1986).

Seen from the perspective of these two concepts, communication is not only about the physical transmissions of information from the sender to the receiver, but is also shaped by the uncertainty of the context where decisions are made in a state of inadequate information, and that this information is socially constructed. While this perspective on communication presents a richer view than the information processing one, it still remains relatively inadequate in considering the broader historical aspects of the context, and how communication is shaped by the varying work practices of the people involved.

In an interesting study, Byrne (2004) describes how richness need not only exist with respect to media, but also around the social processes around how communication is organized. Byrne describe a study of the participatory processes involved in the design of community based information systems in South Africa, analyzing how the Zulu tradition of song and dance, and the historically existing hierarchical relations in the community influenced various facets of the communication processes during the course of participatory design.

Although the media richness theory has been widely used to study media choice over the last two decades (for example, Damian et al. 2000; Sheer and Chen 2004), it has been subjected to various critiques, including its limited focus on the choice of media for analyzing the performance of communicative tasks. Daft and Lengel discuss rich media as a tool for assisting communication, and largely ignore what meanings are conveyed by the information received, and the organizational context within which the communicative act is situated. Implicitly, this perspective makes the assumption that rich media is accessible to participants (Markus 1994; Dennis and Kinney 1998), a situation which in technological terms does not often exist in poor countries like Mozambique. However, the ongoing processes in Mozambique to introduce new ICTs like Internet, makes the perspective important to consider to understand the inherent challenges and how they play out in Mozambican context.

3.2.1.3. Information as symbol and signal

This perspective developed by Feldman and March (1981) emphasizes the symbolic value of information with respect to organizational strategies, and how information is thus deeply embedded in social norms. This perspective thus reflects a *contextual* view of communication, helping to focus not only on the content but also on the broader context of communication. Communication, viewed within this perspective focuses on understanding the symbolic interactions involved in the construction of meaning. Feldman and March critique the assumption underlying the rational approach (exemplified by the information processing perspective) of how decision-making is improved by the use of more information, but instead argue that the collected information

only helps to post-hoc legitimize decisions as being based on the information gathered. The approach of post-hoc legitimization of decisions through the use of information represents a kind of symbol, often used by decision makers primarily for the purposes of enhancing control (Carey 1989). Feldman and March argue:

> Much of the information that is gathered and communicated by individuals and organizations has little decision relevance; much of the information that is used to justify a decision is collected and interpreted after the decision has been made, or substantially made; much of the information gathered in response to requests for information is not considered in the making decisions for which it was requested; regardless of the information available at the time a decision is first considered, more information is requested (Feldman and March 1981, p. 174).

While the perspective on information as signal or symbol is useful in emphasizing both the situated and political nature of actions (Suchman 1987), including of communication action, it can be critiqued for its primary focus on the individual and their uses of information, while relatively deemphasizing the broader social aspects. For example, Carey more generally and Westrup more specifically within the context of information systems, point out to the importance of rituals in shaping important social functions including that of communication (Carey 1989; Westrup 1996). Carey has argued:

> A ritual view does not exclude the process of information transmission or attitude change. It merely contends that one cannot understand these processes alright except insofar as they are cast within an essential ritualistic view of communication and social order (Carey 1989, p. 22).

The above critiques emphasize the need to include aspects surrounding the social context within which communication is taking place. In particular, how the ritualistic aspects of everyday practices are used as a means to reinforce individuals' membership within a particular community. These practices transmit important symbolic aspects and also serve as signals in communication, helping to reinforce particular attitudes of decision-makers, and their political commitment to different choices (Feldman and March 1981).

3.2.1.4. Structurational perspective

This perspective, which is inspired by Giddens' structuration theory (1984) has been drawn upon by information systems researchers to help focus on the processual and situated characteristics of communication through understanding the dynamics of communication within organizations and how they are embedded and enacted in everyday human actions (Fulk 1993; Heracleous and Hendry 2000). For example, Yates and Orlikowski (1992) and Orlikowski and Yates (1994) have articulated the concept of *genre* to theorize communication, helping to extend the ideas of media richness theory beyond physical communication and situate it within the mutual and embedded relationship between human action and social context. Genre is defined by Orlikowski and Yates as "a distinctive type of communicative action characterized by a socially recognized communicative purpose", implying that individuals communicate in ways that are based on situations that tend to reoccur. Furthermore, they argue this "communicative purpose of genre is not rooted in a single individual's motive for communicating, but in a purpose that is constructed, recognized, and reinforced within a community" (Orlikowski and Yates 1994, p. 543). Byrne (2004), also drawing upon a structurational perspective provides an example of how decisions that affect the community are being taken collectively in the Zulu tradition, drawing upon the principles of continuous consultation and consensus. These principles play out in social ceremonies which help to express meanings, such as the need for spiritual and individual reflection (Byrne 2004, p. 111).

An issue of debate in information systems research with respect to the use of structuration theory has been in its conceptualization of technology. Monteiro and Hanseth (1995) have criticized the manner in which technology is conceptualized as representing structures that exist as traces in the mind (Orlikowski and Robey 1991), which deemphasizes the significant material properties of technology. However, in taking technology "seriously", Sahay (2003) argues that ANT-based research tends to examine issues of communication primarily in technical terms of protocols and standards, and in the process deemphasize the role of management practices. Sahay argues:

> While such (ANT inspired) research has helped to understand how standards around artifacts or technology are created, they do not explicitly account for the standardization

> of *management practices and processes*, and how they are redefined through everyday use (Sahay 2003, p. 9).

Walsham (2002) has provided a more subtle application of structuration theory where he conceptualizes technology, not as an independent structure, but as something that is intricately embedded in Giddens' three modalities (norms, power and structures) of structuration. This interpretation of structuration theory, I argue, thus provides a rich potential in the analysis of communication, and elements of it are taken into the conceptualization of communication practices in this thesis.

3.2.1.5. Communicative action perspective

This perspective grounded in the works of the German philosopher and sociologist Habermas (1984), helps to distinguish between different kinds of actions, including communicative action, and their associated rationalities (Heng and De Moor 2003). Grounded within a critical perspective, Habermas has argued that individuals are not only motivated by instrumental purposes, where they perform certain actions as means to achieve particular ends, typically seen as economic in nature. Habermas argues that individuals also engage in a communicative kind of action which reflects the inter-subjective processes through which a mutual and shared understanding is developed. Habermas goes on to argue that a "crisis" situation is developed when the potential of engaging in such communication actions is undermined through the systemic capitalist processes of power and money (Habermas 1984). An implication of these ideas concerns the need to understand and address the distortions that take place in achieving the normative goal of an "Ideal Speech Situation" where communication action can take place with reduced structural or procedural obstructions (Puri 2003).

This critical perspective on communication offered by Habermas has been drawn upon by information systems researchers to analyze processes of information systems development (Lyytinen and Klein 1985; Lyytinen and Hirschheim 1988; Hirschheim and Klein 1989) and everyday social interactions within which information systems are embedded (Cecez-Kecmanovic and Janson 1999). Ngwenyama and Lee (1997) have drawn upon Habermas to analyze communication richness in the context of email

exchanges. Ngwenyama and Lee argue that social aspects are more important than the technological ones of communication. They argue:

> The primary "processing" of data into information, at least in the arena of managerial communication involving an electronic mail system, is performed not by the hardware or software, but by the human beings themselves (Ngwenyama and Lee 1997, p. 2).

Habermas' ideas of communicative action have also been interestingly drawn upon by researchers (for example, Puri 2003; Byrne 2004) studying information systems in developing country contexts (such as in India and South Africa respectively). For example, Puri (2003) has studied the communication processes between the scientists and villagers in the context of GIS development for land management in rural India. While structural conditions of institutional bureaucracies and scientific traditions tend to present "distortions" to achieving idealized communication processes, they can to a certain extent be redressed through the power of indigenous knowledge (of farmers), the use of participatory processes, and by using the GIS technology not only as an instrumental device for land modeling, but also as a mean of communication between the different stakeholders.

Habermas' ideas, especially those concerning the notion of the Ideal Speech Situation have been criticized by various researchers (for example, Fraser 1993) as being too idealized and thus never achievable. The critiques point out that power asymmetries, for example of patriarchy, are always embedded in relations and will thus always distort communication processes. However, as Puri (2003) argues, that Habermas' notion is a normative ideal which we can strive to achieve, and helps to provide an analytical framework to understand the conditions of distortion, and the strategies by which their adverse affects can be reduced.

In conclusion, the five perspectives on communication presented above, provide different analytical lenses to study communication, and come with their own strengths and weaknesses, some of which are discussed here. A summary of the key characteristics and critiques of these perspectives are presented in table 3.1. This summary helps to situate the communication practices perspective, as proposed in this thesis, and highlight its

relative strength and weaknesses.

Table 3.1: Summary of perspectives on communication

Perspective on communication	Key characteristics	Key critiques
Information processing	▪Technical view; ▪Transmission of information through; ▪sender-channel-receiver structure; ▪Meanings contained in the message.	▪Separation of meaning from the context; ▪The sender-receiver structure being limited.
Media richness	▪Focus on clarity of information; ▪Information social constructed; ▪Uncertainty; ▪Equivocality.	▪The limited focus on the choice of media; ▪Assumes rich media is accessible to participants; ▪Deemphasizes the meaning conveyed by the information received.
Information as symbol and signal	▪Contextual view, focus on context of communication; ▪Symbolic value of information; ▪Information embedded in social norms.	▪Primary focus on the individual; ▪De-emphasis of the social context of the information.
The structurational	▪Focus on process of communication; ▪Understanding dynamics of communication; ▪Focus on norms and values that shape communication.	▪Critique on conceptualization of technology as structures that exist as traces in the mind; ▪De-emphasis of the material properties of technology.
Communicative action	▪Develop a mutual and shared understand of communication based on social interactions; ▪Communicative rationality emphasized in addition to instrumental.	▪Ideal Speech Situation can never be achieved; ▪Power asymmetries will always distort communication.

3.2.2. The communication practice perspective proposed in this thesis

The perspective used in this thesis to study communication is articulated through the concept of "communication practices," which takes some elements from the different theoretical ideas presented above, and by also further extending them in at least two ways. Firstly, by incorporating the practice perspective that draws focus on the communication activities involved in the production and interpretation of information. Secondly, by developing the structurational perspective, although more in principle than in terms of using concepts from structuration theory, to highlight the mutually constituting and constituted relationship between health information and communication practices. The symbolic perspective of Carey (1989) is drawn upon to analyze the functional and symbolic roles of information, and how these are constituted in the

everyday social actions of the health staff. This communication practice perspective is further contextualized within the more macro conditions that shape the communication processes such as poor roads and inadequate transportation facilities. These ideas, taken together, help to develop, I argue, a unique perspective to analyze communication and its relation with health information systems.

Thus, the structure, content and transmission of health information is seen to be shaped by how health staff communicate or not with each other, which is in itself structured by the characteristics and requirements of the health information systems defined both by the formal departmental policies and the local level, social and community-based networks within which the health staff are situated. The analytical focus on communication is not only as an individual act but one which is performed in a social setting and thus influenced by historically existing social norms and values, the social identity and the work practices of the health staff, and also the physical conditions such as distances and transport which influence the transmission of reports.

This broad view situates communication practices as mutually intertwined with various facets in the production, transmission and interpretation of the health information. Conceptually, the five key facets seen to shape communication practices are first schematically depicted in Figure 3.1 and then discussed.

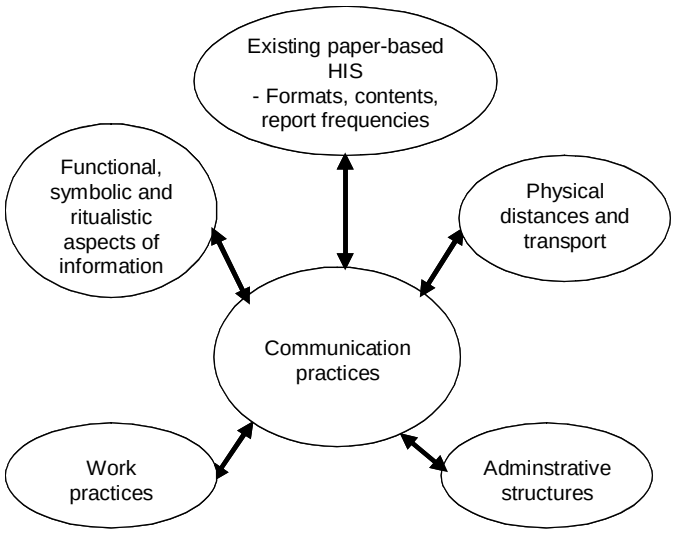

Figure 3.1: Schematic representation of the key facets shaping communication practices

3.2.2.1. Existing paper-based health information systems

The existing health information systems are primarily paper-based and comprise of multiple report forms (for example, forms from Sistema de Informação de Saúde) and artifacts (for example, register books, tick registers). In this case, these paper-based systems, which circulate through the different levels of the health administrative hierarchy, represent the "technology" in the network. This technology is characterized by the report formats, their content in terms of what should be collected for each form, and the frequency of reporting including the means used for the transmission of the reports. These characteristics are intricately connected to the communication practices, for example in defining who fills what forms, when, where, and the difficulties existing in get this job done. While this broad view of communication practices may at certain times be seen to overlap with the idea of work practices, the focus in this thesis is on the communicative aspects of these practices.

3.2.2.2. Administrative structures

The health information systems at a formal level are required to satisfy the reporting needs of the health administrative hierarchy, and are thus shaped by the rules and resources, for example, relating to budgets provided, and the history of technology use in the health department. The administrative structures shapes also the micro-level aspects of the health information systems such as the formats and contents of reports required, their transmission frequency, and what kind of supervisory practices are (or not) in place to ensure quality control of the health reports being produced. The multiplicity the vertical programs existing imply that there are various data collecting and reporting forms. This then requires the coordination of various activities through communication to ensure that consolidated reports for respective health facilities can be produced and transmitted on time.

3.2.2.3. Physical distances and transport

The existing structures require the flow of health reports between the different levels of the administrative hierarchy (for example, district and province). This movement is

shaped by the geographical location of the health facilities, the access to transportation, and the other ongoing needs of the facilities, such as for collecting medicines from the central warehouses. The need to balance competing demands in a largely resource starved context, contributes to delays in the transmission of reports, and the need for local improvisation to complete the tasks. For example, health staff often find members of the community traveling to the province capital for personal business, and then request them to also carry their routine reports. These physical conditions also influence the quality of reports because supervision visits are hard to do regularly, thus impeding regular communication between the users and producers of the health reports.

3.2.2.4. Functional, symbolic and ritualistic aspects of information

Communication practices is seen to be shaped by the characteristics of information – its functional, symbolic and ritualistic aspects – and the processes through which information is produced, transmitted, interpreted, and used. The health information reports serve functional purposes such as to be used for compiling monthly statistical reports, such as on immunization coverage. There are also the symbolic aspects to the information, for example, in terms of the legitimacy it provides of the tasks being completed. These then require the conduct of particular communication practices of certain people meeting each other at particular times and places to perform both defined and also improvised tasks. The manner in which people get together to perform the health information related tasks, has a ritualistic element which both helps to reinforce the membership of individuals to particular groups, while also supporting the functional and symbolic aspects. In any communication act, there are elements of the functional, symbolic and ritualistic intertwined. However, the blend of this intertwining varies with the nature of the communication act.

3.2.2.5. Work practices

The existing work practices of the health staff are based on a sense of social cohesion between the health staff that shape both the delivery of the health care and the goals of the health information systems. Despite the situation of both sets of tasks being characterized by significant existing constraints, for example, related to the heavy

workload of patients, these tasks are performed through effectively organized, situated, and locally improvised communication practices. For example, by being located in the same room, the NEP staff are simultaneously able to do the health information related tasks while also being available to go and meet a patient when required.

In summary, the proposed perspective on communication practices includes the following features:

1. Health information systems both shape and are shaped by communication practices of the health staff.

2. The existing administrative structure of the health department creates templates (of reports content, format and frequency of transmission) which in turn shape and are shaped by the practices of communication.

3. The health information has functional, symbolic and ritualistic roles which are influenced by and also influence the communication practices.

4. The existing work practices (both relating to providing care and also to the health information systems) influence the contents and quality of the health information systems and with it the communication strategies used to accomplish the work tasks.

The above characteristics highlight the broad and contextualized view that the perspective of communication practices provides, helping to transcend primarily technocratic and rational views. Further, it is argued that to further understand the "why" of communication practices, implying why people communicate in certain ways and not in others, it is key to understand the characteristics of social identity. This is discussed in the next section.

3.3. Social identity

Influential writers like Giddens (1991) and Castells (1997) have described identity as a fundamental condition in shaping social transformations in contemporary society within the current context of globalization. Identity has been conceptualized as an emergent and changing source of meanings and values which are internalized by an individual, and

which help to shape their social action (Giddens 1991; Castells 1997). Identity refers to both *social* and *personal* identifications. Tajfel and Turner argue that social identity helps to account for the different ways in which members of a social group behave, and the characteristics of an individual's self-perception as a member of the social group (Tajfel and Turner 1979). Social identity is influenced by the particularities of the context such as the historically existing social norms, the embedded power structures, and also the work practices involved in an individual's everyday actions. Tajfel defines social identity as follows:

> The individual's self-concept derived from knowledge, that he/she belongs to certain social groups together with some emotional and value significance to him/her of the group membership (Tajfel 1972, p. 31).

Relationships are fundamental to analyze how social identity is based on individuals' understanding of themselves in relation to others, and with respect to their past and their future (Peirce 1995). Personal identity refers to self-knowledge that derives from an individual's unique attributes such as their personal characteristics and relationships. Social and personal identities are intrinsically interrelated, as an individual's self-image is shaped by the social group to which he/she belongs, including personal attributes of status and access to resources (Burdsey and Chappell 2003). An individual tends to be embedded simultaneously in multiple networks, which shape his/her sense of both personal and social identities, and which has implications on how they behave in certain ways and why. Social actions, to varying degrees, derive the sense of meaning and identification, from the social group where an individual belongs, which contributes to the perception of their self-image.

Power relations are inherently implicated in the construction and expression of identity. Power is often conceptualised as a commodity (Fook 2002, p. 48), where one person's increase in power implies the decrease of the power of another. This type of notion of power splits people into 'powerful' and 'powerless' (Fook 2002, p. 49), and refers to something that people use and create rather than possess. In Giddens' view, power is given life through processes and structures of interaction. It involves the potential to

control and restrict, to form and to transform as it can be both constraining as well as enabling. Giddens writes:

> Power is the capacity to achieve outcomes; whether or not these are connected to purely sectional interests is not germane to its definition. Power is not, as such, an obstacle to freedom or emancipation but is their very medium - although it would be foolish, of course, to ignore its constraining properties (Giddens 1984, p. 257).

In the context of information systems, Walsham, drawing upon Foucault, emphasizes how everyday micro-level activities are both implicated in and express power structures. Walsham writes:

> The main messages are that power and its use in political activity pervade all action and discourse in organisations, that the exercise of power is a continuous process that has subtle local properties, and that local actions are linked in a complex way to more general networks and institutional frameworks (Walsham 1993, p. 40).

In terms of the process of identity formation, the importance of the concept of power is that not only are individuals regulated by power, but power gives a life and identity for the individual through providing appropriate categorizations – 'a fabric through which to live their lives' (Fook 2002, p. 52). Power is expressed through the discourse, through which we make meaning of and construct our world. In providing, as Fook notes, a medium for communication, discourse also channels and shapes what is communicated and what meanings are derived from it. Discourse also constitutes the bodies and feelings of individuals, since these are also a medium involved in the communication and interpretation of meaning through the medium of verbal or non verbal language (Fook 2002, p. 63), and is the way in which that identity is formed. The language we use is therefore an indication of which value system or which groups are dominant (Fook 2002, p. 63).

In recent years, the study of identity has attracted the attention, although limited, of information systems researchers. For example, D'Mello (2003) has studied the role of self-identity of software development professionals in a global software development organization in India. The membership of the software developers in multiple social

groups like of their families and the organization, and their different ways of identification to these groups helps to create tensions which have, for example, implications on organizational processes like recruitment and retention (D'Mello 2003). Walsham (2000) has analyzed the notion of professional identity in varying contexts including bank managers in the UK, GIS scientists in India, and photocopy maintenance staff in the UK. Studying identity at multiple levels of the social context situated within contemporary processes of globalization, he argues emphasizes the implicit ambiguity with which individuals have to deal with, and its implication on identity. Walsham writes:

> The ever-changing nature of knowledge and the breaking down of trust relations based on local interaction, means that individuals are constantly unsure of who they are, what are their roles in work or in the home, and where they are going in the future. Individuals can no longer rely on being defined by traditional roles, and they may feel insecure or even that life is meaningless (Walsham 2000, p. 292-3).

Thompson's analysis of identity in the context of health information systems in South Africa is especially relevant to my analysis, because it not only explains how individuals exchange the commonly shared symbols to generate meaning and purpose, but also why this happens. Thompson argues for the central role of communication in this process:

> Symbolic interaction is thus a process whereby individuals communicate symbolic forms to each other as vehicles to which they can attach their own significances/meanings, so as to attain ontological security/self actualization and avoid 'anomie'. This can only be attained via communication, since it is only through this process that form and meaning are thus generated (Thompson 2002, p. 187-8).

Contemporary writers (such as Giddens 1991; Beck et al. 1994; Lash 1994; Castells 1997) have in different ways emphasized the concept of reflexivity as a key feature to understand identity, especially how individuals are forced to align and reflexively act according to their changing social relations and contextual conditions. Giddens argues that "identity is lived on a daily basis through biography reflexively organized in terms of flows of social and psychological information about possible ways of life (Giddens 1991, p. 14)." As the possible ways of life and choices about them become multi-dimensional

and ever-changing in the "risk society" (Beck 1992), individuals are forced to monitor their relationship to social structures, and reflexivity redefine their relationships and with it their social identifications. Beck et al. (1994) argue that "reflexive action occur in a process of individualization whereby individuals disembed old ways of life and produce, stage and cobble together their biographies through the re-embedding of new ways of life" (Beck et al. 1994, p. 13).

A point of difference with respect to how reflexivity is conceptualized in relation to identity concerns the primary frame of reference through which identification is constructed. While writers like Beck and Giddens emphasize the role of individual and the self in this process, Castells argues for the role of networks in identity construction and their reflexive reordering. Castells argues that in contemporary society, everyday activities are structured in the context of networks rather than the individual, a feature that is described by Lash as representing the structural conditions of reflexivity (Lash 1994). These structural conditions are constructed in a web of global and local networks of information and technology, which provide the potential to strengthen identity by enabling the sharing of common views, knowledge, and experiences within and across networks.

In the context of this thesis, identity construction and expression are seen to be shaped by three characteristics: one, the structural conditions of networks as the primary source of identification; two, the varying roles of social identity; and, three, the interplay of different forms of identity arising from competing membership in social groups.

Structural conditions: these structural conditions are seen to be comprised by a network, representing various particularities of the context. In this thesis, this is seen to include the historically existing social norms, the existing structures, power dynamics, and work practices and experiences of the health staff. This context is characterized, for example, by problems of inadequate resources, overwork with multiple and competing responsibilities of the health staff, pressure and demands of the health administrative hierarchy, and asymmetries of power. These conditions contribute, to a certain extent, in creating a sense of social identity of the health staff, which in turn shapes both the

delivery of the health care and the relation of people to health information systems, including the new computer-based health information systems. Therefore, an analysis of social identity cannot be conducted in isolation, but within the context in which these social practices are embedded; implying that structural conditions mutually shape and also are being shaped by social identity. Such an analysis helps in understanding the social choices made by health staff and the reasons underlying why these choices are made.

Varying roles of social identity: Sen describes social identity to play two roles: *delineating* and *perceptual* (Sen 1999b). The delineating role refers to the reach and the limits of social concern amongst alternative competing identities and what is considered appropriate conduct by the individual. The *perceptual* function refers to what shapes the individual's perception of the world, the understanding of surrounding reality, and norms. Although the health staff are members of multiple groups such as health department, family, and regional locations which have implications on identity (such as being a Christian), this analysis focuses only on membership in the community and department groups.

This focus was for two main reasons. One, my empirical access was limited, for example it was not possible for me to visit the homes of the staff to understand family relationships. Two, since my focus was primarily on health information systems, I felt that this issue was influenced mainly through the community and departmental memberships. Being members of these two different groups, the health staff implicitly embody multiple identities which are shaped by and also shape the context in which they belong and their everyday practices. For example, health staff are constantly confronted with choices about how they should spend their limited time – for providing care and/or doing administrative tasks. Often their sense of strong social identification with their fellow community members helps to understand their delineating choice of providing care at the expense of administration. Often, at other times, the power structures inherent in the health administration force them into making alternative choices. The perceptual function of their social identification helps individuals to make sense of the norms and

values that make up their competing memberships, what actions are appropriate, and the kind of consequences that may arise if one choice is made over the other or not.

Different forms of identity: As a part of the health network, the social identity of the health staff can be expressed in terms of how goals could be achieved practically and in which ways. In this regard, Castells emphasizes the importance of how a group is formed, by whom and for what purpose. Castells (1997, p. 8) distinguishes between three forms of identity:

- *Legitimizing identity*: introduced by the dominant institutions of society to extend and rationalize their domination *vis-à-vis* social actors;
- *Resistance identity*: generated by social actors in resistance and opposition to the logic of domination permeating from the institutions of society; and,
- *Project identity*: when social actors, on the basis of available cultural materials, seek to build a new identity that redefines their position in society and by so doing, seek the transformation of the overall social structure.

With respect to the relation of the staff with the department and the health information systems, a legitimizing identity can be seen at work enabled through the power structures and hierarchical relationships between those who demand the health reports (the provincial and national authorities) and the health staff at the field level who are the producers of this information. Attempts of the HISP initiative described in this thesis, which seeks to promote the culture of local use of information for action, can be seen as trying to develop a resistance form of identity which would challenge the existing legitimizing identity. How these efforts will succeed or not depends on the power which HISP implementers are themselves able to bring into the process (either through the use of technical expertise, resources or other forms of political persuasion), and the willingness of the health staff to redefine their situation with respect to the existing structures. If they are able to introduce this form of resistance identity, and over time institutionalize these new relationships with respect to health information, the potential for converting this resistance identity to a "project" identity (in Castells' terms) will be created.

Following the discussion of the underlying theoretical framework around the three key conceptual ideas related to counter networks, communication practices and social identity, I analyze how these concepts taken together help to provide insights into the implementation of computer-based health information systems.

3.4. Synthesis of concepts: insights into the challenges of introducing computer-based health information systems

The inter-relationships between the concepts of counter networks, communication practices and social identity taken together help to provide insights into the complexities and also to the possible approaches of introducing and implementing computer-based health information systems within the social world of the health staff in the PHC sector.

The notion of counter network draws attention to the context, the existing adverse conditions such as resource constraints, donor policies, workload, and physical and technological infrastructure limitations. In addition, counter networks focuses on the existing informational capacity, and the potential that lies in the network itself to challenge and redefine these existing conditions through the development of informational capabilities including through the use of ICTs. The strong adversarial conditions that exist emphasize that this informational capacity can not be developed through mere technological fixes but require long term and sustained efforts that are compatible with the existing socio-historic and political context.

These contextual conditions not only shape how the existing health information systems – the registration, compilation, analysis, and transmission of data – are structured, but also influence the processes around the introduction of the new computer-based health information systems. These include challenges such as those faced by the facilitators to access the field sites to provide support, or the unreliable electricity situation which influences the use of computers, and the manner in which donor politics creates competition amongst systems.

The notion of communication practices draws attention to the micro-level activities that goes into the production, transmission and use of the health information systems. These

include details of the content, formats and frequency of reports, to aspects of who carries or receives the report, and when and how this travel may take place. Communication is described as a key aspect which helps to give shape to the processes around the health information systems and is also intimately shaped by them. Efforts to introduce new computer-based health information systems need to fundamentally understand the characteristics of the existing social context, how the computerized system influences – practically and perceptually - the configuration of this context, and how the actors tend to respond to this reconfiguration. For example, even a relatively trivial issue of placing the computer in one room 15 meters distant from where the staff are currently situated upsets the practicalities of how health staff communicate with other both in the process of providing health care and in the compilation of the health information system. Communication, at one level is influenced even by the physical settings, and at another level is shaped by the more macro issues of workloads, and the administrative requirements placed by the health department.

The notion of social identity is important to understand better the reasons underlying the characteristics of communication practices, and to also help situate the health staff within the multiple networks to which they belong – relating to the community and also the health department. This multiplicity of memberships place (sometimes) competing demands – of providing care and fulfilling administrative responsibilities – on the health staff, and with it their notions around social identity. Communication practices are not only then shaped by this sense of social identity, but also through the everyday routines through which they are expressed, help to shape the processes of identity construction. For example, being involved in the computerization efforts is seen by some of the health staff as a means to reflexively enhance their relative status, and also as a potential vehicle to develop new career related opportunities, such as finding new employment in international agencies or in the private or non-governmental sector. Social identity construction and expression needs to be thus conceptualized as a recursive process, one which is reflexively managed, monitored and revised. Efforts at introducing computers thus needs to be sensitive to these reflexive processes of identity construction and how new systems may influence these processes.

The existing identity in the PHC sector could be described, using Castells' terminology, as primarily a 'legitimizing identity' influenced through the power relationships within the different hierarchical levels of the health system and the social relationships between the health service providers and community. As discussed above, the formation of identity is influenced by the power relationships within the health system. The power dynamics between and within the various levels of the health administrative hierarchy is crucial in the understanding of the linkages between the people, their thinking and actions, and the broader social structures.

The PHC sector, interpreted as being constituted in a network, is comprised of various groups of people and levels of hierarchy, who interact with others in the process of providing health care, carrying out various administrative tasks such as the reporting of routine data, and for social interchange. I argue that social identity is constituted and reflected within these networks of relationships, which is sometimes supportive, yet dysfunctional at other times. Therefore, health staff, as members of this network, have to deal with ongoing tensions in their everyday work, such as reporting demands which take marginal importance in comparison to their pressing and more desired need to provide health care to fellow community members who travel long distances to reach the clinic.

Taken together, these three concepts of counter networks, communication practices and social identity help to describe the "social world" of the PHC sector, schematically described in Figure 3. 2 below, in which elements of each are intertwined with each other.

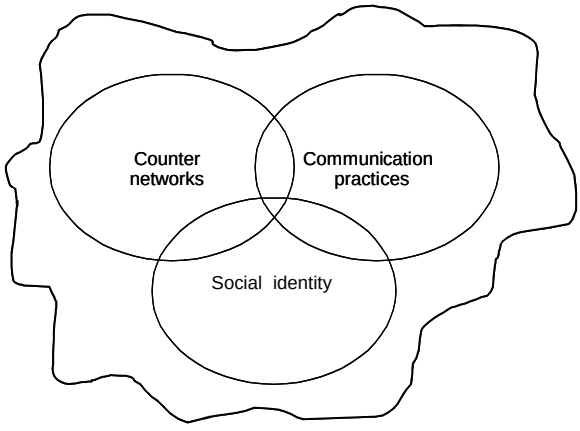

Figure 3.2: Social world of the PHC sector.

I draw upon Knorr Cetina's use of the term "social world" to describe the people, their relationships, and practices that exist in a particular setting. Knorr Cetina writes:

> Many authors are aware of the fact that the influx of some of these objects and object-worlds into the social world has brought profound change to the way we work and spend our space time. But it may also bring profound change to the structure of relationships, and call for the rethinking of sociality along lines that include objects in the concept of social relations (Knorr-Cetina and Bruegger 2002, p. 162).

In my case, the notions of counter network, social identity and communication practices helps to conceptualize the people, their relationships and practices related to the health information systems. The notion of social world then helps to examine some of the theoretical synergies that are developed in looking at these three concepts in conjunction rather than in isolation. Three such synergies are discussed:

1. To understand the potential for change that lies within the network;
2. To understand the processes of counter-domination or resistance as they unfold; and,
3. To understand more holistically the interaction between the introduction of computer-based health information systems and the social world.

These are briefly discussed, and will be returned to further in the last chapter of the thesis.

1. The potential for change: The idea of the social world helps to emphasize the historically and socially embedded nature of the relationships between the staff working in the PHC with each other, with themselves and the community of which they are also members, and with the health information systems which is the focus of this thesis. This historical embeddedness, it is argued, itself provides an inherent potential for change. For example, the long standing tradition of sharing resources in the community, such as borrowing a car from a member of the community by the health facility to transport a sick patient to the province hospital, indicates the mutual respect that exists locally. This potential can be

developed, for example, through group exercises for training sessions when the more experienced members can support the weaker ones.

2. The process of "counter-domination" or resistance: The idea of social world also helps to emphasize the deep rooted power structures that exist, and how there are interweaved in my understanding of social identity. These power structures are implicated in the structure, format and contents of the health information systems, and their production, transmission and use. The mutual relationship between health information systems and communication practices helps to analytically examine how power structures shape this interaction, and also how the process of resistance may unfold. This process is seen to be built around the strengthening of informational capacity by developing the informational culture and its networking linkages. The resources for this strengthening lies partially in the network itself, and also external initiatives like HISP need to try and harness this potential, and also provide additional capabilities through the power of ICTs, and training and support to create the capacity to use the technology more effectively for support of the local needs of the health staff.

3. The interaction between the social world and computerization efforts: The notion of the social world helps to analytically examine some of the tensions that arise when attempts are made to introduce the computer-based health information systems into this social world. At least two sets of tensions can be identified. The first concerns the tensions arising from the fact that the computerization represents a change effort which seeks to reconfigure this social world, while a fundamental condition for this effort to succeed is the need to be sensitive and respectful of how the social relations between this world are currently configured, and in trying to maintain this stability. A second tension results from the needs of the computerization effort to introduce structure and formality into the informational activities. However, to implement these structured processes (for example, being able to send monthly reports from the district to the province over the Internet), requires necessary infrastructure and conditions (a working network and reliable power supply) which is often not in place. To deal with these

"missing pieces," health staff need to improvise in emergent ways, which can run counter to the need for structure and formality.

In summary, the three concepts taken together help to develop a context-sensitive and social-informed understanding of the challenges in introducing computer-based health information systems in a developing country context like Mozambique. Similar conceptual analysis, it can be argued, can also be applied to other developing country context. While issues of networks, communication practice and social identity will remain salient in a different context, the particularities of their characteristics and how they play out will vary.

CHAPTER FOUR

4. RESEARCH APPROACH

In this chapter, I present the methodology adopted for this research, including a description of the research setting, data collection methods and analysis techniques. The empirical work is informed by an interpretive approach which rests on the fundamental assumption that knowledge is socially constructed, and is shaped by and also shapes the social context (Walsham 1993). The interpretive perspective in my case enables the consolidation of the understanding of the social and organizational issues that shape the interplay between communication practices, social identity, and ICT implementation.

The chapter is structured as follows. In section 4.1, I describe my personal motivation to conduct the research. In section 4.2, I provide the background of the research, including some historical aspects of the HISP initiative. In section 4.3, I discuss the research approach including details about the action research approach and case study methods. In section 4.4, I describe the research sites, data collection sources and techniques used for data collection. Finally, in section 4.5, I provide details of the process of analysis.

4.1. Motivation

The HISP initiative was established in the Department of Mathematics and Informatics, and in the Faculty of Medicine at the Eduardo Mondlane University, Mozambique. Being a lecturer in the Informatics Department, along with two other colleagues who dealt with issues of information systems, I was introduced to the HISP initiative. A multidisciplinary "HISP" team was established comprising of researchers from Informatics and Medicine and this created opportunities to develop a social systems perspective informed by public health and informatics to analyze and improve health information systems in the national context. A formal Memorandum of Understanding (MoU) was established between the University of Oslo, Eduardo Mondlane University and the Ministry of Health in 2000 to implement HISP in the three pilot districts – Cuamba, Maxixe, and Chockwe (located in the provinces of Niassa, Inhambane and Gaza respectively), which also served as field sites for training of medical students from

Eduardo Mondlane University. These pilot sites location was later extended to include all the districts in the three provinces. Visits to various HISP research sites during the initial implementation period (2000) and contacts with health workers aroused my interest to try to contribute to the improvement of health care delivery through the potential of ICTs. More specifically, I was interested in developing a deeper understanding of the micro level processes around the collection, analysis and transmission of health data, and how these practices shape the implementation of computer-based health information systems. Within the HISP team members, we had various debates and discussions around the inability of the existing health information system to effectively support the process of health care delivery, and the underlying reasons for this. These discussions further heightened my motivation to work together with the team to try to address some of the existing challenges.

In 2001, an opportunity opened up to pursue PhD studies at the Department of Informatics at University of Oslo with funding from the Norwegian government. Initially, my interest was to understand the impacts that the computer systems were having on communication. But I soon realized, that the computer systems were not yet working and thus the impacts were not yet there to see. I then decided to refocus my thesis on understanding the very local-level existing communication practices of the health personnel and how they shape the introduction of computer-based health information systems. Particularly, I was interested in understanding the communication practices of the staff both between themselves and across the hierarchical levels of the administration and how these interacted with the change efforts. As my thesis developed, I started to participate in research conferences, especially of the IFIP 9.4 community, where I met other researchers pursuing similar studies but in other contexts, which helped to develop self-confidence about the relevance of my work.

4.2. Background of the research

HISP was first initiated in South Africa in 1994 and is currently ongoing as a global research and development initiative in various countries including Mozambique, India, Malawi, Tanzania, and Ethiopia. HISP is described as a network with these various

countries representing inter connected nodes (Braa et al. 2004). Structurally, in each of these nodes, there are collaboration agreements between the University of Oslo (Norway), local universities and the ministries of health, like in Mozambique there is a MoU between the University of Oslo, Eduardo Mondlane University and the Ministry of Health. Key components of the MoU typically include: health information design and development; education and training; and financial support (Braa et al. 2004). The PhD research (of myself and the 4 other HISP team members) was to draw upon HISP as the sites (the three pilot districts) for the empirical work and also through the action research orientation, support the introduction of the computer-based health information systems in these selected districts.

In contrast with the situation in most developing countries which are typically characterized by centralized information systems (Lippeveld et al. 2000), HISP focuses on the local work of districts and sub-districts to try to develop the capacity of the health staff to enable local control of health information, and to use it to support their own and local action (Opit 1987). In this way, within an action research framework (Eden and Huxham 1991; Braa et al. 2004), HISP seeks to redress the existing imbalance between top-down planning processes (for example, in the allocation of resources) and local level information needs, so as to provide a stronger informational basis to support health care especially in rural areas. However, in practice, bringing about such changes to redress this imbalance is an extremely complex and long-term task requiring also radical structural changes, for example, in the decentralization of decision making authority and budgets. Contributing to these reform efforts has been a key focus of HISP.

HISP has developed a free and open source software application – District Health Information System (DHIS), which is based on Microsoft Access and provides tools for data collection, storage, analysis and reporting. Technically, the core module of the software is written in Visual Basic for Applications (VBA), the programming language used by Microsoft Access. Data analysis and charts are in most cases developed through an Access-based “Report Generator” using pivot tables and chart capabilities available in Microsoft Excel. The free desktop GIS viewer ArcExplorer is provided to represent the health data through maps. The DHIS application runs on all standard computers that can

support Windows 95/98/NT/2000/XP and Microsoft Office. The hardware requirements related to memory and hard disk space increase with the size of the data sets[13]. The DHIS application allows health workers to enter data on a routine basis (monthly, quarterly and annually), and to add demographic data from census and surveys, so as to develop routine health reports and to allow for the analysis of performance with respect to identified health indicators.

4.3. Research Approach

The research approach was based on three founding principles: an interpretive approach; an action research framework; and, case study methods. These are now discussed.

4.3.1. Interpretive approach

The research approach was broadly based on an interpretive approach which rests on the founding assumption that access to reality is only through social constructions such as language, consciousness and shared meanings (Walsham 1993; Myers and Avison 2002). In an organizational context, this reality is socially embedded in the way people interact with each other in everyday life. As Jonsson writes, 'people act on their subjective interpretation of the world they perceive" and "it can be only interpreted' (Jonsson 1991, p. 376).

An interpretive approach is in contrast to a positivist approach which focuses on formal propositions, quantifiable measures of variables, hypotheses testing, and making statistical generalizations from a sample where the phenomenon is studied to a larger population (Orlikowski and Baroudi 1991). A positivist approach assumes the relationship between human and social reality as "independent," implying that the phenomena of study is not influenced by the "bias" of the researcher (Orlikowski and Baroudi 1991; Levin 1994). Positivist studies seek to test theory in an attempt to increase

[13] The data include the following:
1. Routine data: collected monthly by the health staff relating to various health programs such as immunization, mother and child, communicable diseases etc;
2. Semi-permanent data: resources available such as drugs, finance, transport, demographic data etc
3. Permanent data: refer to the infrastructure, human resources.

the predictive rather than descriptive understanding of phenomena under investigation (Walsham 1995b).

In contrast, an interpretive approach as used in my study, focused on understanding the social processes surrounding the collection of health information, through formal meetings, informal conversations with people, observation of their physical movements and of artifacts, analyzing the circulation of information, including the use of books, registers, forms, and more recently, computers. The focus more broadly was on understanding the communication practices underlying these flows. These communication practices occur in a social context where beliefs, values and construction of meaning are deeply embedded in the everyday life of the health staff. Thus, the interpretive perspective helps to focus on understanding these formal and informal communication practices that surround, and are constituted in the flow of health information. Since my research focus is on developing an in-depth understanding of such communication practices, an interpretive rather than a positivist approach was adopted.

The interpretive approach adopted drew largely upon qualitative methods of data collection that aim to study people in their natural context by observing, talking and reading what they have written. More specifically, the qualitative methods used in the study included semi-structured interviews, meetings, participant observation, and secondary data collection including of forms, manuals and health status reports. In addition, I was involved in conducting training, presenting seminars, and having discussions with HISP team members around the challenges experienced in the field research and also related to theoretical ideas.

Following this brief description of the grounding philosophical assumptions of the research, I describe the action research framework adopted.

4.3.2. Action Research

This research was situated within the larger action research initiative of HISP that is constituted of two components - research and action (Braa et al. 2004). This approach is based on the assumption that a complex process can be best understood by introducing

changes and studying the effects of these changes (Baskerville 1999). My research approach, based on this perspective, firstly, aimed to increase understanding of the social processes around the introduction of ICTs through observation and the application of theoretical knowledge, and, secondly to try to solve the practical problems that arose during the implementation process. The combination of these two components helped to develop a deeper and micro-level understanding of the communication practices of the health staff and how these shaped the implementation of computer-based health information systems. This understanding helped to develop practical implications on how these practices may be changed to enable more effective introduction of the computer-based health information systems.

The action research approach adopted in this study did not follow an explicitly structured methodology covering various sequential phases of diagnosing, action planning, action taking, evaluating, and specifying learning (Susman and Evered 1978). However, implicitly there was a process of initial diagnosis of the problem situation, and then of taking action and reflecting upon the results of that. The diagnosis relating to the need for strengthening the health information systems was to a large extent conducted by the University of Oslo faculty and the ministry officials, and was reflected in the contents of the MoU. For example, the selection of the pilot sites was determined through the MoU. The action aspect was comprised of various interventions such as seminars, training-courses, software development and language translation, and the preparation of reports and documents such as training materials. These interventions were carried out together with other members of the HISP team and whenever it was possible with senior managers from the Ministry of Health. For example, the head of Health Information Systems Department was a key facilitator in many of the training courses carried out in the provinces, which helped to enhance communication between various levels of the health administrative hierarchy (Puri et al. 2004).

Reflections on the effect of these interventions took place through various mechanisms including discussions, meetings, reading relevant literature and making presentations in conferences. These activities in different ways helped me to develop a deeper understanding of the relation between communication practices and the process of

introduction of computer-based health information systems. For example, by observing the lack of use of the DHIS, I interpreted how the use of the computer software was considered less important by health staff as compared to using the existing paper based information system.

4.3.3. Case studies

A comparative case study method comprising of two districts[14] was adopted for this study. A case study aims at investigating a contemporary phenomenon within its natural settings (Benbasat et al. 1987), especially when the boundaries between the phenomenon and its context are not clearly evident (Yin 1994). Moreover, a comparative case study approach in my research allowed a comparison of similar phenomenon (of introduction of computer-based health information systems) across two districts represented by varying conditions of geography, distance, weather, poverty, and electricity supply, all of which had direct implications on how the health staff dealt with health information. For example, variations in geographical distances between the clinic and district offices contributed to different levels of delays in sending data to the district and province offices. In the next subsection, I describe the case study sites in more detail.

4.4. Research setting and fieldwork

After an initial survey conducted in Mozambique by the HISP team in 1999 (Braa et al. 2001) to understand the status of computer and health related information in three provinces, three districts were selected for the implementation of HISP[15]. These districts (Cuamba, Chockwe and Maxixe) were selected because they were seen to have relatively advanced infrastructure (buildings, computers, etc) and as already stated, had been identified through the MoU. As time went by, the HISP scope was changed to include all the districts in each of these three provinces. My focus however was on two districts (Cuamba and Xai-Xai) located in two different provinces (Niassa and Gaza).

[14] These two districts were also amongst the pilot sites identified by the MoU referred to earlier.
[15] HISP started officially in 1999 after the initial fieldwork in June-July 1998 (Gaza and Inhambane) and November 1999 (Niassa).

4.4.1. Field research

My fieldwork can be conceptualized at two levels: at the macro-level[16] including studying the offices in Ministry of Health along with other HISP team members, and conducting joint activities such as workshops and training to the provincial and district health managers; at the micro-level of the two health districts where the HISP project was ongoing to conduct in-depth case studies of health information systems related practices.

4.4.1.1. At the macro level

Three important mechanisms for data collection were adopted: meetings in Ministry of Health; discussions with HISP team members; and conducting training programs in the provinces.

i) Ministry of Health

Within the Ministry of Health, the fieldwork was comprised of participation in pre-arranged meetings with senior managers, especially those in charge of the health information systems at the Departamento de Sistemas de Informação para a Saúde[17]. These discussions revolved around strategic issues of software selection, choices of pilot sites, training approaches, and implementation scheduling. Various documents and reports were made available for our analysis through these meetings such as the PESS (Strategic Plan for Health Sector). At the Ministry of Health, we also had the opportunity to have discussions with various expatriates representing donor agencies which helped to gain a perspective on the characteristics of donor influence on health information systems design and development. Within the ministry, the HISP team were often invited to attend interdepartmental meetings, and give presentations to donor agencies, which gave insights into issues of more strategic importance.

[16] At this level, most of the activities were carried out in collaboration with the other HISP team members.
[17] Information Systems Department for Health

ii) HISP team meetings

Initially, within HISP, we had weekly meetings held in the Faculty of Medicine where current issues around the project including details about the DHIS rollout of the training program were planned, and administrative issues relating to allowances for travel to support our fieldwork were discussed. Roles and responsibilities of the team members were agreed upon with respect to different tasks such as database creation, software translation, preparation of training materials, etc. In the initial stages, a senior member from the Ministry of Health also participated in the meetings, but with time and due to busy and uncoordinated schedules, this practice slowly faded away as did the routine of the weekly meetings. An important group task that was successfully carried out by the HISP team was the translation of the DHIS software and the training manual from English to Portuguese. The initial software translation was hard coded which led to numerous practical problems such as having the pop-up of windows with English text, which could not be easily understood by the Portuguese speaking users (Kimaro and Nhampossa 2005). These problems were eased, however, with the release of the multi-language version of DHIS in 2002. A printout of a list of more than 250 text strings was given to each individual team member to translate, and difficulties in interpreting these terms were attempted to be resolved by making a phone call to other project members or to ministry officials. For example, a typical literal translation of the string ‘data element’ would be ‘elemento de dados’. However, on discussions with the health staff we found that in the health context, the term used for the same was ‘variável’ (variable in English).

Activities such as software customization and translation required an active collaborative process between the HISP team members and the health staff which involved discussions, debates, and cross-checking in the field setting. However, as team members became increasingly embedded in their respective PhD studies, the practice of meetings stopped, which in hindsight can be argued to have been detrimental to the project efforts. Specifically, the Ministry of Health staff interpreted this as a lack of interest from our side which contributed to their reluctance to give official sanction for a full rollout of HISP in the districts.

iii) Province level training

A number of training seminars and workshops were conducted in the three HISP pilot provinces. Typically, I played the role of a facilitator, making presentations and supporting practical exercises on computer skills, such as for making tables and charts, and to introduce the trainees to basic concepts on the use of computers. Making these training programs effective was very difficult as many participants had not even touched a computer before. For example, many hours were spent to explain how to move a mouse on the mouse pad and coordinate the movement of the mouse arrow on the screen with the touch of that mouse. These problems were typically dealt with in a very informal way, often with discussions about issues and problems taking place in the evenings over a meal and drinks.

Training programs were also conducted within the structure of the Masters in Health Informatics Program run in collaboration between the Eduardo Mondlane and Oslo Universities. I participated in two field trips where along with a group of students from the Health Informatics and Public Health programs we visited the provinces of Gaza (April 2002 and April 2004) and Inhambane (March 2004). A total of 11 districts in both the provinces were visited. Through these discussions with students, and by reading their reports and theses, I gained further understanding of the perceived challenges relating to the existing systems and also in introducing the computer-based health information systems.

The macro-level activities described above helped me to develop a broader understanding of the challenges around health information systems, for example, the level of computer literacy of participants. This understanding raised my motivation to practically contribute to the HISP action research efforts of training, software customization, and relationship building. This exposure also helped me in the selection of my two case study sites – Xai-Xai in the Gaza province and Cuamba in Niassa. Details of how the case studies were conducted are now provided.

4.4.1.2. Micro-level: Research sites

In addition to gaining an overall understanding related to health information systems and information needs of the health sector through the macro-level analysis described above, I conducted in-depth case studies in two health districts, Cuamba and Xai-Xai, located in Niassa and Gaza provinces respectively (see Figure 4.1 and 4.2).

Cuamba district was selected as it was the first HISP pilot site, and it was ongoing for a longer period than other sites. This helped me to gain a more processual perspective on the HISP implementation. Xai-Xai was chosen primarily due to its proximity to my place of residence (Maputo) which facilitated a relatively more continuous interaction with the health staff in this district. This interaction with health staff helped in the development of trust, which allowed me to build a greater shared understanding with the participants, and to engage more actively in solving their practical problems. In contrast, in Niassa which could be accessed by flight costing about USD$ 500, I could only make 4 trips over the 3-4 years research period.

As these districts varied significantly in terms of population, infrastructure, and proximity to Maputo (see maps below), a comparative case study design was adopted in order to see how the context influenced the characteristics of communication practices and its relation to the introduction of computer-based health information systems.

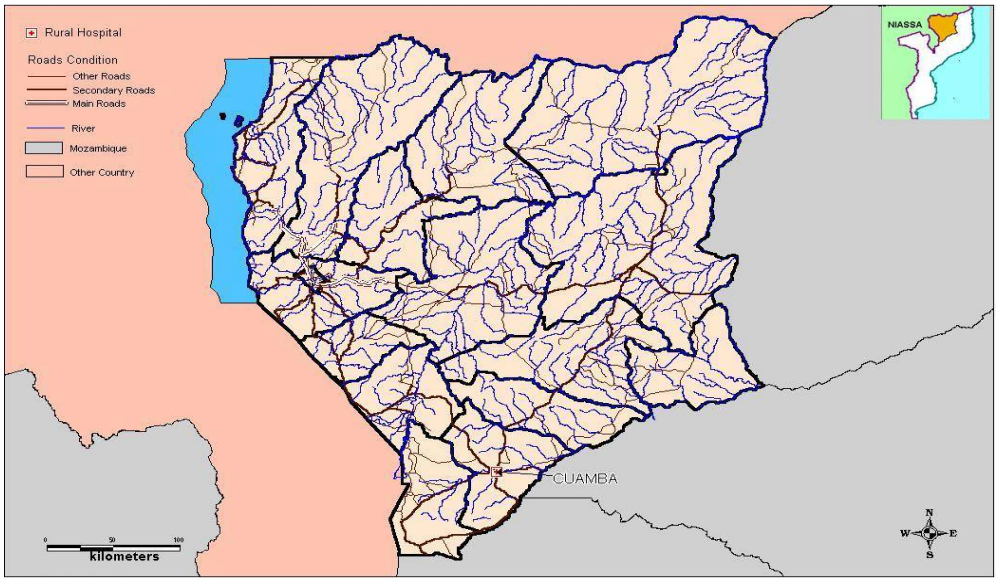

Figure 4.1: Map of field site of Cuamba

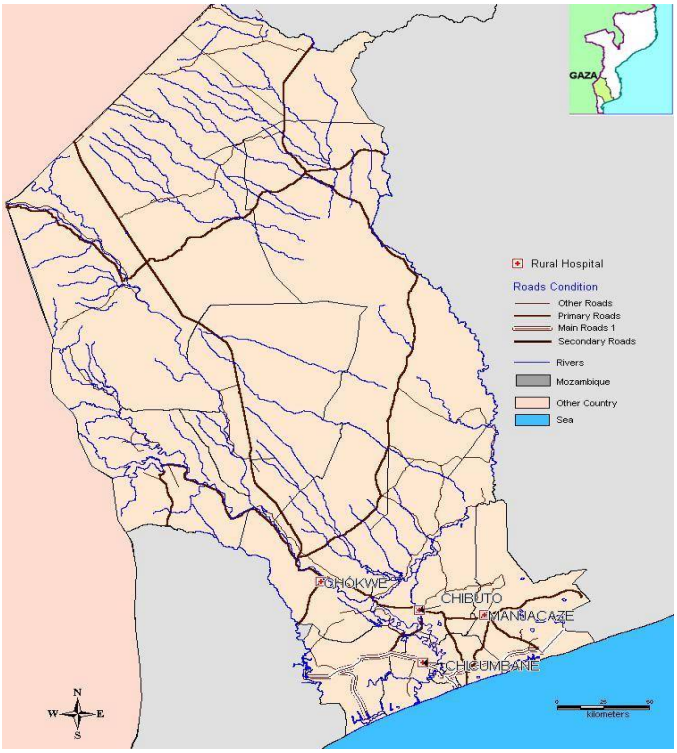

Figure 4.2: Map of field site of Xai-Xai

The level of my engagement varied with the district, and also with what I describe as the four phases of the research: contextualization; capacity building; continuous interaction; and analysis. *Contextualization* refers to my initial attempts to develop an understanding of the health system and the field research sites; *Capacity building* refers to the various activities carried out, (for example, training and data entry) by me and the other HISP team members to develop local capacity amongst the health staff to use information more effectively. *Continuous interaction* refers to my involvement in trying to solve practical problems, such as reinstalling software, during the course of the research. *Analysis* refers broadly to the reflection process in trying to critically consider the effect of our efforts and what learning can be drawn from the experience. Table 4.1, summarize the phases of field work carried out in the two districts including the timings and specifics of the action taken.

Table 4.1: Field work in Xai-Xai and Cuamba

Place	Research phase	Time period	Action taken
Xai-Xai (district office and 3 health centers)	Contextualization	Nov 2001	•Installation of DHIS; •training health staff on data entry and data analysis; •contextualization of Xai-Xai in the health system.
	Capacity building	Mar 2002	•follow up to ensure the data entry; •analysis of 2001 reports from clinics/district; •assistance of the health staff in data entry; •interviews.
	Continuous interaction	May – July 2002	•interviews and observation; •facilitation of data entry and technical support.
	Analysis	Feb 2003	•data entry, training on information use, DHIS, data analysis; •interviews: clinic and district personnel; •group discussion with district personnel.
Cuamba (district office and 3 health centers)	Contextualization	Jun 2000	•installation of DHIS in the health district; •training health staff on data entry, data analysis; •familiarization with context of Cuamba.
	Capacity building	July – Aug 2000	•follow up to ensure the data entry; •assistance of the health staff in data entry; •analysis of the 1999 and 2000 reports from clinics/district; •observation of the staff while working at health center.
	Continuous interaction	Mar 2002	•training for the whole health staff of Niassa province on health information systems, information use, DHIS, data analysis; •interviews district/province.
	Analysis	Nov 2003	•training and follow up; •interviews; •group discussions with provincial personnel.

4.4.2. Data collection

Fieldwork was carried out during the period from June 2000 to April 2003. Data were collected through formal and informal interviews and informal meetings with health information systems personnel[18]. The personnel met ranged from doctors, the head of the health districts, pharmacists from both the district and provincial levels, heads of various programs (such as Immunization and Mother and Child), nurses, community health

[18] Formal interview referred to pre-arranged meetings. Informal interviews were discussions carried out in unplanned and chance meetings with health staff. Informal meetings were also unplanned discussions with a group of health staff.

workers including servants who were responsible to collect medicines from the district to take to the clinics. The interviews were typically in-depth and semi-structured, lasting between half to one hour. In addition, several informal conversations and discussions took place with senior staff at the provincial and national levels. Field notes were taken during interviews and later transcribed. No tape recording of interviews took place. Relevant quotes from transcribed material were selected to emphasize key themes during the writing process. Respondents were asked questions about the existing health information system, communication between levels, their relation to the clinics, province and national levels, and with the community, and the frequency of communication between them and other levels of administrative hierarchy. These questions and interactions with the health staff helped to understand their meanings and interpret their social identity.

To gain a better understanding of the relationship of the health staff with the community, I also visited in both the districts a number of health posts and centers[19] which served as the first point of contact of the community with the health department. Here, I observed the number of people waiting for services, and also asked them questions about their time to travel, their waiting time in the clinics, their relationship with the health staff and quality of service they felt they received. In these health posts, I also talked to the voluntary worker (called ACS - Community Health Agent) to understand their interactions with the community.

Some photographs were taken, for example of the room in which the NEP people worked and the pasted statistics on the wall (see Figure 4.3 and 4.4). The distance between the rooms helped to understand in greater detail the structure of the communication processes for example, the time taken for a staff to go from one room to another where someone else was located. Observations were also made, for example of how many patients visiting the clinic everyday. This helped me to gain an understanding of the work load of the staff.

[19] A total of 6 clinics, however, the total number of clinics visited during the period of study in the three provinces were 22.

Figure 4.3: The training room in Xai-Xai

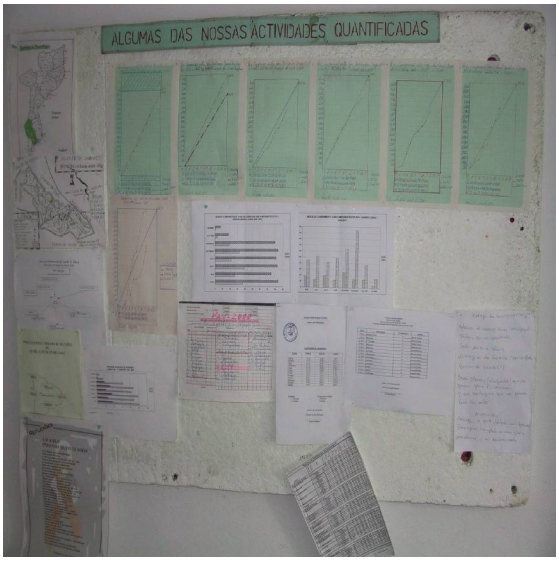

Figure 4.4: Statistics on the board

Besides the primary case study sites, several other districts were also visited within the HISP framework, for example with the Masters students or with other HISP team members. The duration of stay in these districts was limited typically to a few days. In total, more than 18 districts in three provinces were visited. Table 4.2 gives details of these visits during the period from 2000 to 2003. These visits helped to build a comparative understanding of the issues in relation to the case study sites. Some of the visits were carried out along with research advisors from the University of Oslo that allowed for discussions around alternative interpretations. In these visits, I assisted health staff on data entry and in providing training. For example, existing data from 2001 clinics' paper reports in Xai-Xai and from 1999 and 2001 in Cuamba were entered into the database. Furthermore, various documents including different reports, especially monthly and weekly routine forms on disease surveillance, official manuals for the health information systems, and the strategic plan for the health sector, were collected and subsequently examined. The interviews were conducted in Portuguese, and in some cases I translated the conversations to English because of the presence of non-Portuguese speaking colleagues and advisors.

Table 4.2: Summary of field work (visited district, No of visits and No. of interviews)

Period	**Inhambane**	Visits	Interviews	**Gaza**	Visits	Interviews	**Niassa**	Visits	Interviews	**Total**
2000 - 2004	Inhambane	2	5	Xai-Xai	7	16	Cuamba	4	21	
	Maxixe	3	4	Bilene	5	10	Marrupa	1	1	
	Homoine	2	4	Manjacaze	1		Lichinga	2	15	
	Morrumbene	5	10	Chockwe	1					
	Massinga	3	10							
	Funhalouro	1	1							
	Inhassoro	1	1							
	Vilanculos	1	2							
	Jangamo	1	1							
	Inharrime	1	1							
Total			**39**			**26**			**37**	**102**

Note: *Some of the interviews were repeated, especially in Cuamba and Xai-Xai.*

4.5. Data analysis

Data analysis was broadly informed by the interpretive approach adopted in this research. The focus was on understanding the relationship between various levels of the health system, and the characteristics of existing working practices and how these influenced the health information systems.

In subsequent visits to the field research sites (in 2002 and 2003), certain analytical methods (Miles and Huberman 1994) were often used to see the frequency of use of the software, which was important to understand the implementation dynamics. For example, I used to check the system log on dates of the last time a particular user (health worker) had entered data into the system. When I found large gaps between the consecutive dates of log on, I would query the health staff on the reasons for this. This capture of context sensitive data, for example relating to staff workload, or distance between district and province, helped me to develop a deeper understanding of how the context shaped communication practices and its linkages with the introduction of computer-based health information systems. While writing up the findings from these studies, some of which were presented in conferences and journals, the reading of available literature helped to

further develop a theoretical basis to understand the relationship of communication practices, identity, and health information systems implementation.

Individual interpretations drawn from the analysis of empirical data collected during field work were discussed with my research advisors, with the health staff, and with other HISP team members. These discussions helped to develop coherence in my interpretation, and in writing papers and reports.

A process of reflexivity can be seen to characterize my analytical journey. An interesting example in this regard is my conceptualization of counter networks. In the first paper of my thesis, drawing upon Castells I described counter networks as follows:

> Counter networks as heterogeneous socio-technical information infrastructures … that can help to integrate various sectors of society and provide the first steps to the social inclusion of people, organizations and systems within broader socio-economic development processes (Mosse and Sahay 2001).

This paper which was presented in the IRIS 2001 conference was criticized for adopting a concept that was too macro to describe a micro phenomenon. Subsequently, on reading more about the issue, along with my co-author (Sundeep Sahay), we described counter networks as the HISP initiative trying to change an existing disadvantaged situation. However, the reviewers of the paper criticized this approach as if tended to ignore what already existed in the situation. Then, we described counter networks as follows:

> Counter networks as a notion that helps to emphasize the sustained and long term effort that is required to develop networks and to emphasize the very contrary assumptions around the role of ICTs made in contemporary conceptualizations of the "network society" (Mosse and Sahay 2005).

This concept was subjected to further change in writing the Kappa of this thesis. Here, I described counter networks primarily as a metaphor to emphasize the adverse conditions existing in the context including the lack of transport, roads, ICT infrastructure etc. This conceptualization was criticized in the trial defense as being very negative, and for

ignoring the potentialities that exist as a result of this historically disadvantaged situation. I then reworked this concept, and presented it as following as it appears now in the thesis.

> The term counter networks is used in the manner of emphasizing the long term and sustained efforts that are required to deal with the existing constraints, so as to enable the PHC sector to use the power of ICTs and networks to make visible their problems, advocate the need for greater resources, and promote their access to more knowledge and expertise so as to deal with their existing problems, including to conceptualize the relationships between health staff, their practices - both around providing care and conducting routine administrative tasks of data processing by drawing attention to the informational aspects of the network, and how the "informational capacity" can be strengthened. Here the emphasis is on the existing informational capacity, and the potential that lies in the network itself to challenge and redefine these existing conditions through the development of informational capabilities including through the use of ICTs.

This above example illustrates 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.

In conclusion, in this chapter, I have presented details of my research, including my personal motivations, research background, approach, methods, and data collection and analysis techniques. The articles in the appendixes explain the details of the specific fieldwork in relation to particular papers. In the next chapter, I present a summary of the findings of these research papers.

CHAPTER FIVE

RESEARCH FINDINGS

5. Summary of research findings

The aim of this chapter is to discuss the findings of the research papers included in this thesis. The complete references of the papers, included in annexes of this thesis, are as follows:

i. Counter Networks and Social Exclusion: The Case of Health Information in Mozambique (Mosse, E. and Sahay, S. (2001). In *The Proceedings of the 24th Information Systems Research Seminar in Scandinavia (IRIS' 24)* Bjørnestad, Moe, Mørch, and Opdahl (Eds), Ulvik in Hardanger, Norway);

ii. Counter Networks, Communication and Health Information Systems: A Case Study from Mozambique (Mosse, E. and Sahay, S. (2003). In *The IFIP TC8 & TC9/ WG8.2+9.4 Working Conference on Information Systems Perspectives and Challenges in the Context of Globalization*. M. Korpela, R. Montealegre and A. Poulymenakou (Eds). Athens, Greece**:** 35-51);

iii. The Role of Communication Practices in the Strengthening of Counter Networks: Case Experiences from the Health Sector of Mozambique (Mosse, E. and Sahay, S. (2005) (forthcoming). In *The Journal of Information Technology for Development*);

iv. Communication Practices as Functions, Rituals and Symbols: Challenges for Computerisation of Paper-based Information Systems (Mosse, E. and Nielsen, P. (2004). In *Electronic Journal for Information Systems in Developing Countries*, 18(3): 1-17);

v. The Role of Identity in Health Information Systems Development: A Case Analysis from Mozambique (Mosse, E. and Byrne, E. (2005) (forthcoming). In *The Journal of Information Technology for Development*).

I now present a brief summary of each of the included papers, following which I synthesize the findings and discuss how they contribute to the broader research questions

posed by the thesis. A further discussion of the research contributions will be presented in chapter six.

5.1. Counter Networks and Social Exclusion: The Case of Health Information in Mozambique

This paper is situated within the broader debate around globalization processes contributing simultaneously to dialectical effects of growth and marginalization. While ICTs are seen as important tools for development, they also have marginalizing tendencies in that for reasons of history and geography, many segments of society do not have the capacity to access these new technologies. This lack of access contributes to their social exclusion and with it further systematic marginalization. The concept of "counter network[20]," which finds its inspiration in the work of Castells, is proposed as an approach to make visible and address this problem of marginalization (Giddens 1991; Castells 1996).

The empirical basis for this analysis is in the significantly under-resourced primary health care sector of Mozambique, one of the poorest countries in the world. The potential of ICTs to support the functioning of this sector is argued for, and the need for human capacity development to achieve these ends is emphasized. In establishing effective information infrastructures, the fundamental role of communication is emphasized in defining who is included and excluded from the network. Thus, communication is defined as the key basis for the creation of these counter networks.

An attempt to create such a counter network through the Health Information System Program (HISP) is briefly described, emphasizing its approaches of participation, local development, and decentralization. The notion of counter network helps to emphasize that while historically, marginalized groups and regions of society need to join the "network society" to counter the state of their historical marginalization, the strategies to do so need to consider carefully the "counter" conditions that exist relating to infrastructure and human resource capacity.

[20] While in this paper, counter network is discussed more as a metaphor, in the following paper, we have attempted to develop a more concrete description of the term.

5.2. Counter Networks, Communication and Health Information Systems: A Case Study from Mozambique

This paper builds upon the earlier paper in that it develops the theoretical concept of communication practices, and how it relates to counter networks. Communication practices are seen to both constitute and be constituted by the flows of health information from the health facility upwards through the various levels of the health hierarchy - district, province and national. Communication practices are described in this paper as involving people "… their meetings and conversations with others, their physical movements to circulate information, their use of various forms and artifacts, such as books and registers, and current attempts to apply ICTs (Mosse and Sahay 2003, p. 36)." These communication practices are seen as a fundamental component of "counter networks". Understanding locally specific practices are crucial to the success or not of broader attempts to introduce ICTs, such as the HISP, which is the subject of study of this thesis.

The empirical basis for the analysis of communication practices is provided by my study of health information flows in the Xai-Xai district of Mozambique. 13 interviews were conducted in the district in the period from April to June 2002 with follow up research in 2003. The interpretive analysis yielded deep insights into various facets of communication practices including how the health information flows took place both within the health facility and also across different levels of the health administrative hierarchy.

The communication practices were seen to be shaped by various aspects such as:

- The physical layouts of where people were seated;
- Who carried the data, for example the nurse or the servant;
- The time of the day when the data was delivered;
- The availability of transportation and the quality of roads;
- The workload of the health staff; and,
- The hierarchical relationship between the health facilities.

This micro-level analysis of communication practices yielded socially-sensitive insights into the implementation challenges being faced by HISP. For example, the attempts by HISP to integrate various data sets into a common form run counter to the manner in which the existing work is organized both in physical and administrative terms. A key implication arising from this analysis is therefore the need to develop implementation approaches that are compatible with the existing communication practices.

5.3. The Role of Communication Practices in the Strengthening of Counter Networks: Case Experiences from the Health Sector of Mozambique

This paper further builds upon the notion of counter networks to emphasize the effort and action that needs to go into incorporating marginalized sections of society like the PHC sector into the logic of information flows that characterize the network society.

Counter networks is thus conceptualized not in ontological terms of "what it is" but rather in an epistemological sense of the effort required to construct it. The paper takes a normative stance that the construction of such counter networks is important to improve the functioning of the PHC sector. The existing gaps and constraints in constructing these networks are identified, and with it certain strategies to address them.

Four key constraints identified in prior literature to the construction of these counter networks are: inadequate resources; overworked health workers; structure of the health administration; and, the role of international funding agencies. These four constraints are described as "adversaries", using Castells' terminology, to the PHC sector. It is argued that the approach for addressing these four "adversaries" needs to take place at both the conceptual and operational levels. While the conceptual level helps to emphasize the sustained and long term effort that is required to develop the networks, the operational level helps to identify the practical tactics required to construct the network. A focus of these operational level strategies is to develop mechanisms that can create the potential for learning and sharing of experiences across different actors and entities in the counter network.

Drawing upon the Xai-Xai case study material, which was also used in the second paper, the following four key constraints are identified in the construction of counter networks

in Mozambique: conflicts in identity of the health staff; uncoordinated donor policy; structural constraints; and, pressures of existing work practices. Developing effective communication strategies are seen as a fundamental mechanism for addressing the above constraints. The operational level strategies identified include:

- Being sensitive to the local context of communication;
- Dealing with structural constraints that shape communication practices; and,
- Changing the focus of what is being communicated.

A key implication drawn from the analysis is that the thinking around counter networks needs to shift from a structural focus to the action required to construct them. This action necessarily needs to be sustained and long term in nature.

5.4. Communication Practices as Functions, Rituals and Symbols: Challenges for Computerization of Paper-based Information Systems

The focus of this paper is on unpacking the meaning of communication practices in the context of understanding health information flows. An interpretive approach to the analysis of communication helps to provide deeper insight into the context and process of health information systems implementation.

The perspective on communication is developed based on two theoretical streams concerning structuration theory and practice-based research. Such a conceptualization helps to go beyond the information processing perspective that has typically dominated information systems research on communication (Mosse and Nielsen 2004). The theoretical perspective developed identified three interconnected aspects of communication practices: the functional; the symbolic; and, the ritualistic. These elements emphasize aspects of efficiencies, meaning, and group membership respectively.

The theoretical perspective developed around communication is applied to the analysis of health information flows in Xai-Xai district of Mozambique. These flows are analyzed at three levels: within and between the health facilities and districts, district and provinces, and province and national levels. The analysis helped to identify characteristics of

communication practices and to develop specific recommendations to strengthen them. For example, some recommendations for the health facility level were as follows:

- Need to improve functional aspects of the data in terms of quality and completeness;
- Need to strengthen the symbolic trust in the reports submitted by the health facilities; and,
- Create a stronger ritual towards emphasizing the quality of data.

Similar recommendations were also developed for the district, provincial and national levels. The implications of ICTs in the health sector in the light of this analysis is that while ICTs have the potential to improve efficiencies in the functional aspects of communication, they may undermine the ritualistic aspects concerning how people work in a group setting to perform health information systems related tasks. The symbolic aspects of communication practices can also be enhanced by ICTs because often health staff ascribe a high status to computers. The broader implication of the study for ICT projects is not only to consider the functional aspects, but also the ritualistic and symbolic roles of communication practices.

5.5. The Role of Identity in Health Information Systems Development: A Case Analysis from Mozambique

This paper focuses on the concept of social or collective identity and its relation to health information systems implementation. The role of identity in understanding contemporary social transformation has been emphasized by various writers (Giddens 1991; Beck et al. 1994; Lash 1994; Castells 1997). While reflexivity is emphasized by each of these authors as a key element of identity construction, the paper discusses the differences in their focus on the self, structural or network aspects. The paper draws upon Castells to argue for the use of networks as an appropriate concept to study how reflexive processes are shaped. Drawing further from Castells, three types of identity are discussed – legitimizing, resistance, and project. The role of ICTs in shaping these processes of identity formation is discussed, and also the effects of marginalization and exclusion that can arise as a result of a lack of access to these technologies, or in the capacity to harness its potential effectively.

The empirical basis for this analysis is provided by a case study of health information systems implementation in Cuamba district of Niassa province in Northern Mozambique. A total of 37 interviews with health staff were conducted over 4 visits during the period of 2000-2003. In addition, extensive data collection was done through observations, the conduct of training sessions, and the study reports and documents, such as data collection forms, registers, and other artefacts.

The interpretive analysis of the data collected in the context of the implementation study of the HISP initiative helped to identify important challenges with respect to identity. In this paper, the existing structure within the health system is described to favour a legitimizing kind of identity influenced through the hierarchical relationships between the different levels of the health administration, and also between the health staff and the community. The membership of the health staff within these two different networks (formal and community based) and the tensions arising as a result are identified to have implications on the health information systems implementation.

The HISP initiative which is seeking to develop a more resistance-based identity because of its emphasis on local-level capacity building, has to deal with these ongoing tensions. To address this, various communication-based strategies are being adopted including emphasizing the importance of feedback, facilitation of meetings across various layers of the health staff, and using a "cluster strategy" to share resources between districts that have computers with those who do not. Various challenges being experienced in implementing these strategies in this ongoing initiative are described in the paper.

Following this brief summary of the individual research papers, I analyze the linkages between the papers, and how they contribute to answer the broader research questions posed in the thesis.

5.6. Synthesis of findings

The papers included in this thesis elaborate on three main analytical concepts: counter networks communication practices, and social or collective identity. These three concepts taken together provide the conceptual basis to address the four research questions that

have been posed in the thesis: i) What are the characteristics of a "counter network" in relation to the primary health care sector of a disadvantaged remote area, for example in Mozambique?; ii) What are the characteristics of the communication practices within and between different levels of the health structure – how are they constituted, expressed and shaped?; iii) How does an understanding of the relationship between communication practices and social identity provide insights into the dynamics of the health information systems implementation?; and iv) How can a context-sensitive understanding of communication practices and social identity enable the development of more effective practical health information systems introduction strategies?

The first research question concerns understanding the characteristics of counter networks in the context of PHC sector in Mozambique. The basic assumption underlying the use of this term is to emphasize the adverse conditions that exist with respect to the efforts required to enable the PHC sector to become actively included in the "network society." These adverse conditions for historical reasons arise from the colonial legacy and the ensuing civil war where communication (for example, telephone lines) and physical (for example, buildings and roads) infrastructure, especially in the health and education sectors was destroyed and neglected. Reasons of geography also contribute to this situation including aspects of distance (especially in remote areas such as Niassa), poor roads and transportation networks. The term counter networks is used in the manner of emphasizing the long term and sustained efforts that are required to deal with these existing constraints, so as to enable the PHC sector to use the power of ICTs and networks to make visible their problems, advocate the need for greater resources, and promote their access to more knowledge and expertise so as to deal with their existing problems.

The second research question concerns the understanding of the characteristics of communication practices in the context of this study. Communication practices have been described as being deeply embedded in the social context and shaped by the everyday practices of the health staff. Communication practices are seen to be shaped by physical settings, the channel through which reports are transmitted, timings of transmission, administrative relationships, social interactions with community, and the physical and

transportation infrastructure. By analytically defining communication practices as being constituted and also constituting the flows of information between and across the various levels of the health administration hierarchy, approaches for strengthening communication practices are seen to contribute directly to improve the health information flows with respect to both their structure and content. Implementing computer-based health information systems, that are compatible with the existing communication practices – in terms of their functions, rituals and symbols – are more likely to be accepted by the users than systems which are not sensitive to the existing "design-reality" gaps (Heeks et al. 1999). The role of communication is emphasized as a key process in shaping counter networks with a focus on enabling and strengthening mechanisms by which learning and experiences can also be shared horizontally in the network rather than just the upward reporting.

The third research question concerns the linkage between communication and social identity. Social identity is described to form the third base of the conceptual framework, the other two being counter networks and communication practices. The analysis helps to emphasize that communication practices are intricately linked up to questions of social identity. Sen's (1999b) argument is drawn upon to emphasize that identity plays both delineating and perceptual roles in defining how choices are made and the meanings that these choices have for the actors involved. These choices and their underlying meanings thus shape what is communicated, to whom, and how. It is further argued that these choices, in contemporary settings, are shaped within networks, and thus the creation of counter networks need to fundamentally take place based on a cognizance of the linkages between communication practices and social identity. As identities within networks are constructed through a continual reflexive reordering of social relations in the light of the changing context, the notion of reflexivity is emphasized in understanding the linkages between communication practices, social identity and health information systems introduction.

The fourth research question concerns the development of effective health information systems introduction strategies through a context-sensitive understanding of both communication practices and social identity. The papers included in this thesis, in

different ways, contribute to answering this question. Firstly, the concept of counter network helps to better contextualize the identity - communication practices relationship. The concept of counter network, as argued earlier, emphasizes that the introduction efforts in disadvantaged settings like the PHC sector in Mozambique need to be necessarily sustained and long term in nature. Secondly, the focus on understanding existing communication practices and how they are intricately intertwined with the flows of health information is necessary to develop introduction strategies that support rather than disrupt existing ways of doing things within the PHC sector. Thirdly, the analytical notion of social identity helps in to further go "underneath" the communication practices to understand better why do they take place in certain ways and not in others. To analyze this, it is argued that the health worker needs to be understood to be situated within two sometimes competing networks (the formal and the community based) which places varying demands on him/her, with implications on how communication practices are shaped and expressed.

In conclusion, the three concepts developed in the five papers, and their interlinkages taken together help to both analyze the existing challenges in implementing health information systems and also to develop effective strategies to address them. In table 5.1 below, a summary of the four research questions posed in this thesis is provided.

Table 5.1: Summary of findings and research questions

	Research Question	Findings
1.	What are the characteristics of a "counter network" in relation to the primary health care centre of disadvantage remote area like Mozambique?	• Inadequate infrastructure and human resources both in terms of quantity and quality; • Structure of the health administration, that emphasizes top-down decision making; • Overburdened health workers; • Uncoordinated donor policies; • Multiple pressures arising from existing work practices.
2.	What are the characteristics of the communication practices within and between different levels of the health structure – how are they constituted, expressed and shaped?	• Deeply embedded in the historical context of the social networks; • Mutually constitute and constituted by the flows of health information; • Shape and also shaped by the structural conditions and the everyday work practices of the health staff; • They play a fundamental role in shaping and strengthening counter networks.
3.	How does the relationship between communication practices and social identity shape the dynamics of the HIS implementation?	• Membership in multiple networks (formal and community based) help shape the social identity of health staff; • The delineating and perceptual roles of social identity shape the characteristics and expression of communication practices and with it the health information flows; • Strategies to change include enabling horizontal flows of information, changing the focus of what is being communicated, and the local sharing of resources between the "haves" and "have not".
4.	How can a sensitive understanding of communication practices and social identity help to develop more effective practical HIS implementation strategies?	• Counter networks help to emphasize the sustained effort required; • Understanding various facets of ongoing communication practices help develop implementation strategies that are compatible with the existing social situation and practices; • A focus on social identity helps to understand the "why" of communication practices in addition to the "how".

In the following chapter, on theoretical contributions and conclusions, I take this analysis further by looking at the theoretical synergies that arise by looking at these three concepts in conjunction, as compared to the rather isolated analysis presented in this chapter.

CHAPTER SIX

6. CONTRIBUTIONS AND CONCLUSIONS

The contributions, theoretical and practical, arising from the thesis can be framed in the backdrop of the research questions posed in the introduction of the thesis. While in Chapter 5 (section 5.6 on synthesis of findings), I have discussed briefly how the five papers included in the thesis help to answer the research questions, here the aim is to go further and discuss how in answering the questions, specific contributions are made to research, with a focus on the information systems domain. The chapter is thus structured around the four research questions posed in the introduction of the thesis: i) what are the characteristics of counter networks in relation to the PHC sector of a disadvantaged remote area, for example in Mozambique; ii) what are the characteristics of the communication practices within and between different levels of the health structure – how are they constituted, expressed and shaped; iii) how does an understanding of the relationship between communication practices and social identity provide insights into the dynamics of health information systems introduction; and, iv) how can a context-sensitive understanding of communication practices and social identity enable the development of more effective practical health information systems introduction strategies. The contributions are now discussed, following which some brief conclusions of this thesis are presented.

6.1. Characteristics of the counter networks

While the idea of networks has always been an important object of study in the domains of organization studies and information systems research, it has in recent years gained increased currency especially following Manuel Castells' (1997) analysis of the characteristics of social transformation in contemporary society. Castells has described networks as the dominant type of organizational form in current times, which is built upon the twin axes of information and technology. Castells has argued that innovations in organizations in current times are largely dependent on their ability to leverage the power of networks and enhance the informational component of the services offered by them.

A unique aspect of Castells analysis is its global-empirical basis as contrasted to the works of some other prominent writers on globalization such as Beck and Giddens who present a predominantly European focus (Walsham 2001). This global focus of Castells' analysis thus provides the potential to examine the unequal access which groups, societies and countries have to become active members of the network society, and also simultaneously how hitherto marginalized groups can draw upon the power of ICT-based networks to engage in counter domination activities to redress their disadvantaged status. The potential of counter domination which Castells argues to exist in networks makes it especially relevant to my analysis of the PHC sector in Mozambique. This potential is expressed in this thesis through the idea of counter networks, where the network aspects emphasizes the need for technical and social connectivity, and the counter idea helps to make visible the various adversaries in establishing these networks in practice. Situating these networks within a broader socio-historical and political context, not only helps to understand the existing adversarial conditions, but also to identify the potential for change that exists in these networks themselves. Articulating this notion of counter networks, operationalizing it in the context of the PHC sector in Mozambique, and identifying both the adversarial conditions and potentialities, I argue is a key contribution of this thesis. This perspective helps to question the technology deterministic arguments often brought forward both by information systems researchers and governmental policy makers that ICTs can help developing countries to leapfrog the historically existing divide between the rich and poor countries, and also between the rich and poor in developed countries (Avgerou 2003).

In a later paper, Castells (2000) argues that his use of network as a metaphor reflects the exploratory nature of his ideas, and its use primarily as a vehicle to develop meaningful insights into the context of contemporary social transformations. Furthermore, he argues, on subjecting these metaphors to rigorous empirical examinations, they can be further developed into concepts. This thesis makes a contribution with respect to this need for further empirical examination as argued for by Castells as follows:

> The provisional outcome of my research should allow us to stop using the notion of information society (but still keeping informationalism as a mode of development, …),

> and replace it with the concept of network society, as the specific social structure characteristic of our time. This is not a terminological matter. It is replacing description with a concept. A concept proposes specific meaning, and pretends to be based on observation (Castells 2000, p. 110).

Castells further argues:

> The Net is an information network (or network of networks) that execute(s) a program of instructions originated from dominant values and interests in a given organization. By the way, I did define precisely in my book what a network is, ... So, the Net was used as metaphor but not the concept of network, which is central to my analysis (ibid, p. 112).

This thesis makes a contribution towards developing Castells' use of network as a metaphor to that of a concept through a rigorous empirical examination. Firstly, the importance of the PHC sector to join the network society is argued for, so as to make visible the health status and problems of previously excluded regions. Secondly, some of the reasons for this exclusion are identified, which are historically and politically embedded, and thus which cannot be addressed through simple technological fixes. Thirdly, it is argued that these exclusionary tendencies are not inevitable and insurmountable, but can be gradually addressed through locally sensitive interventions, especially through the strengthening of communication practices.

There is the potential for change inherent in these networks, but these need to be sensitively harnessed. An important issue to consider here is what are the resources that can be drawn upon to harness this potential and for bringing in new capabilities. Through the empirical analysis, it is argued that the resources come primarily through two ways. The first, concerns the existing potentialities inherent in the network arising from the historical nature of the social relationships. For example, during one visit to a clinic, I asked one health staff where did they print the graphs that were pasted on the wall since they had no printers in the facility. I was told that the health staff had gone across to the office of a nearby NGO and had used the printer there (on a voluntary rather than commercial basis) to print the maps. I was also told by the health staff in another clinic that they often borrow the car of a community member to transport a sick patient to the

province hospital when the official car is not available. These examples show that the historically existing tradition of sharing resources on a mutual basis is vibrant, and this creates the potential also for further strengthening informational linkages. For example, often community members carry the official reports to the next level if they happen to be heading in that direction. This practice could be further strengthened maybe by providing them some formal responsibilities (and incentives) to do these tasks, which could help to free up the precious and scare time of the health staff being spent on carrying reports.

Another set of resources comes from the HISP program who are seeking to draw upon the material capabilities of the software, and through training on its use to strengthen the existing information culture and to improve the informational linkages. For example, one of the features of the software is to allow data to be entered for the lowest level of the health structure (the health unit). This allows people on the top to "drill-down" to this lowest level and analyze a health problem (for example, related to the geographical spread of the maternal mortality problem). In the existing paper-based systems, the reports which go from the health unit, are aggregated at the district level, implying that people at the province level can not drill-down to the lowest level to analyze the geographical distribution of a health problem. This process of aggregation thus forces the problem to remain invisible to the authorities above, and reduces the lowest level's power to advocate for more resources and focused interventions. It is exactly such informational capabilities that Castells argues to be enhanced in order for marginalized regions to try and redefine their deprived status.

The HISP effort is also seeking to redefine the existing information culture where health reports contain data which have little meaning for the health staff other than it fulfilling the needs of the bureaucracy. Through a conscious effort to enhance the "local use of information for action," HISP is trying to get the health staff to value health information for the support it provides to their everyday action. Such a change, it is argued, can also help to strengthen the informational culture and overall capability of the PHC sector.

The focus on identifying approaches to develop informational capabilities to enable participation in the network society, I argue, is another significant contribution of the

thesis. While in my case, certain approaches to achieve these objectives are identified, in other (developing country) situations, alternatives approaches would need to be articulated based on local conditions and contextualized understandings.

6.2. Characteristics of communication practices

In Chapter three (section 3.2.1), various perspectives on communication developed by researchers in the context of information systems were presented. It was within this backdrop, that the perspective of communication practices as proposed in this thesis was articulated. A key contribution of this thesis concerns this conceptualization, and the implications that this has more broadly for information systems research. An important aspect of my conceptualization is that the challenge of communication is neither only technical nor social, but socio-technical in origin, shaped by history and also the existing infrastructural conditions, both technical and physical. Communication is described to be inextricably intertwined with health information systems through a structurational relationship of each influencing and being influenced by the other. By describing this relationship to be fundamentally linked to the everyday work practices of the people involved, a contribution is also made to develop a better understanding of the "practices" related to health information systems in developing countries, and the macro-micro linkage within which it is situated. This conceptualization thus helps to contribute to the "practice turn" in information systems, which Orlikowski and Yates (2002) describe, in the following way, to be significant in how people construct and reconstruct temporal structures that shape their lives:

> Focusing on one side or the other misses seeing how temporal structures emerge from and are embedded in the varied and ongoing social practices of people in different communities and historical periods, and at the same time how such temporal structures powerfully shape those practices in turn (Orlikowski and Yates 2002, p. 686).

While communication has been studied within various domains such as development studies (for example, Joshi 1991), and media studies (for example, Windhal et al. 1992) and innovation (for example, Rogers 1995), this thesis emphasizes the need to address the study of communication also at a more micro-level of everyday practices of the health

staff. For example, Joshi's perspective on development emphasizes the role of communication in reducing inequality in the efforts to create an integrated and "developed" society (Joshi 1991). While recognizing the potential of modern communication technologies, Joshi, using the case of India, argues for the need to design communication strategies in order to leverage the opportunities provided by new media and technologies. Rogers (1995), in his diffusion of innovations theory, emphasizes how issues of the context, such as the locally existing critical mass and interpersonal channels are important in helping to diffuse innovations in societies. This thesis offers further new insights into understanding the local context through emphasizing the role of micro-level aspects of communication in organizations. Broader communication processes such as plans to electronically link remote clinics with district and provincial level headquarters, cannot be wholly successful without adequately considering these micro-level communication processes of the people involved.

In the empirical analysis, I saw many examples of how existing communication practices shape the production, transmission, and use of health information systems. For example, depending on who carried the report from the health unit to the district, influenced to some degree the perceived quality of the report. If the report was carried by a servant, the person receiving it did not trust the figures reported as compared to when it was carried by the nurse. This element of trust also had implications on data quality because the person receiving the reports would seek clarifications on the data from the nurse but not the servant. The physical location of where people sat, influenced their communication interactions, which had implications on how effectively the health staff could fill the reports, while concurrently performing their health care tasks.

The above examples point out to the intricate relationship between communication practices and health information systems, and provides insights into how these practices can be strengthened to support the development of informational capabilities. The ability of the people to do multiple tasks in parallel, can provide interesting implications on how training may be made more effective, or the existing use of graphs pasted on the wall indicates a familiarity with graphs, that can be drawn upon to make inter-facility comparisons, or in comparing trends over time.

6.3. Relation between communication practices and social identity

Identity can be viewed as emergent and changing sources of meaning and values which are internalized by an individual or collective (Giddens 1991; Castells 1997). The process of internalizing is reflexively and recursively constructed and shaped by the context and social experiences of the individual or group. Individuals often have difficulty in relating to global experiences from which they are often excluded, and find it easier to identify to a communal group and their values, shared experiences, and language. Group identity is expressed through a collective's day-to-day activities, for example, concerning defining the goals to achieve, and situating themselves within respective networks which underpin how these goals can be achieved in practice (Castells, 2000).

Castells (1997) also describes identity as people's source of meaning and experience. Identity refers to a process of construction of meaning on the basis of a set of cultural attributes that are given priority over other sources of meaning. Castells differentiates between identity and roles as he sees the latter relating primarily to functions, while identity refers to sources of meaning for individuals. Social actors can have a plurality of identities, which can serve as a source of stress and contradiction in self-representation and social action. However, as my case points out, this contradiction can also be positive, seen from the examples of sharing of resources between the community and the health staff. Castells argues that an important question in this regard is "how, from what, by whom, and for what" (p. 7) is identity constructed. Castells sees communication to play a key role in this process. He writes:

> The agencies voicing identity projects aimed at changing cultural codes must be symbol mobilizers. They ought to act on the culture of real virtuality that frames communication in the network society, subverting it on behalf of alternative values, and introducing codes emerging from autonomous identity projects (p. 361).

Castells distinction between legitimizing, resistance and project identities emphasize the key role of power in the construction of these identities. While historically, power has been situated in institutions like the state, the labor movement, and the church, Castells

describes a “new form” of power that is increasingly becoming significant in the network society. He writes:

> The new power lies in the codes of information and in the images of representation around which societies organize their institutions, and people build their lives, and decide their behaviour. The sites of this power are people’s minds … power is a function of an endless battle around the cultural codes of society (p. 359-360).

Castells’ argument thus helps to highlight the significant role of power in identity construction, and the role of communication in redefining existing cultural codes and thus redefining this power-identity relationship.

In my case, the PHC sector provides an arena for the health staff to be understood in a multiplicity of social relationships, contributing to multiple and shifting identities. The health staff can be seen as members various groups including the community, the health department, their family, regional grouping etc. For lack of empirical access to the other groups, my focus was primarily on understanding the identities of the health staff in reference to the community and departmental memberships. With respect to the community, the meanings shaping the relationships seem to be founded on values of mutual respect, sharing, and commitment. An example of mutual respect can be gauged from the fact that I found in Niassa province, when the governor went on leave or out of station, the health director of the province became the acting governor. This indicates the respect and status the health staff formally has in the province. Informally too, the doctor in the district, is seen as the most educated person in the community and thus serves as a source of knowledge to whom the community members approach for advise.

Examples of sharing resources with the community (borrowing a car or using the printer at the office of the NGO) have already been provided as an indication of the social bonding that exists between the community and health staff. The commitment of the health staff towards the community is quite evident in the everyday work of the clinic, where I found the staff to be providing care to sometimes even 100-150 patients a day. I found them doing this work in a very pleasant manner, and always trying to exchange some personal bits of information (like about their family or children’s school) during the

course of providing care. These different examples and anecdotes lead me to interpret a very positive sense of identity that the health staff have with respect to the community, one which is expressed and played out in their everyday works and in their interaction with the community both while providing care and in social interaction.

The other source of social identification for the health staff comes from their membership in the health department. There is a legitimizing kind of identity at play, where the formal structures of hierarchy favour a top down decision making, and bottom-up data flows. This structure helps to define the flows of health information and the related communication practices. The existing information culture, earlier defined as what information is valued and why, thus represents a focus on data, where the formal reports hold little functional significance to the health staff with respect to their own work, other than the symbolic meaning of the reports being seen to be sent on time (to the extent possible). In the field work, I saw one health nurse spend the whole day taking care of patients (nearly 100), and then in the evening she went to the office to write down the figures. I saw her randomly put a figure of the number of patients she saw (which I found to be more than the actual cases she had seen). When asked how she remembers the numbers, she said “it does not really matter, I fill in approximate figures only to make sure the reports are sent.” In the information culture that existed in the micro world of the health staff, data became information not through formal structure of the reports, but was more defined by the emergent health care needs of the people coming to the clinics. It was more important for the nurses to ensure that all the patients who come have received care, rather than divert their scarce and precious time towards conducting administrative tasks. This information culture in which the formal reports hold limited meaning for local action is also reinforced by the situation where the health staff see little relevant action being taken by the higher structures based on the reports sent to them. For example, in one case a health staff told me that she had requested extra drugs and received only half of that. When asked why that was the case, she replied that the higher ups just send what they have or want, irrespective of what the reports say or what requests are specifically made.

The above examples illustrate that networking between and within the sources of domination and those dominated, and the sharing of common language and images are essential components of the identity formation and revision processes. Attempts like of HISP to introduce new computer-based systems need to necessarily engage with existing social identities as they try to introduce new symbols, images and meanings, which have implications on both the communication practices and the processes of identification and their expression. Information systems design and development can help to redefine context, as well as in changing the communication structures within the network. This can be achieved through the establishment of information flows and communication loops that helps foster a "collective resistance identity," rather than the all too familiar approach of perpetuating an information systems that reinforces the communication patterns of domination and power of the higher levels. The introduction of ICTs can facilitate access to these global flows and thus provides the potential to strengthen social identity by enabling the sharing of common views and concerns across different networks.

The awareness and exposure to ICTs which the health staff receives through the HISP initiative was also seen to trigger off interesting processes of reflexivity. For example, the nurses in Xai-Xai district used to have conversations with me about the alternative career paths they may be able to take with a computer background. In between my visits to the district, I found that one of the nurses had left to join an international NGO working in the region, and also another was contemplating a move to Maputo which was seen to provide more opportunities in terms of employment and possibilities for further studies.

The linkage between identity and communication has been discussed in the domain of organization studies research, especially to understand cross-cultural relationships (Tanno and Gonzalez 1998). With some exceptions, in information systems research, this linkage has remained largely unexplored. Thompson and Walsham (2002) have discussed the relation between identity and knowledge, which has implications for the analysis of the communication and identity relationship. Processes around knowledge include their construction of mutually understood meanings and their communication to enable sharing across different groups of people. Thompson and Walsham argue:

> In cases where knowledge consists of emergent, inter-subjective communication, we suggest that attention should be directed to cultivating the interactive environments in which cultural identities are able to flourish, so that knowledge is never divorced from the context which imbues it with meaning and value (Thompson and Walsham 2001, p. 713).

Byrne (2004) discusses the relation between identity and communication through the analysis of community-based information systems for the care of vulnerable children in South Africa. She explains that song, dance and poetry fundamentally constitute the identity of the members of the Zulu community, and this helped her to formulate during the participatory design process her approach to enabling communication that was compatible with this sense of social identity. She writes:

> In keeping with traditional forms of communication, face-to-face communication was largely relied upon. The use of song, dance and poetry was also encouraged (Byrne 2004, p. 183).

In the conceptualization of social identity in this thesis (see Chapter three, section 3.3), three aspects are discussed including the role of identity, the membership of people in multiple groups, and the frame of reference around the processes of reflexivity. These aspects have particular implications on the shaping of communication practices and of the informational culture. The perceptual and delineating roles of identity have implications on the choices made by the health staff about whom to communicate with or not, and the underlying norms and values that shape these choices. For example, the health staff are permanently challenged by their need to make choices of providing health care or doing administrative tasks. These are made in relation to their social identity, constructed through a continual reflexive reordering of their relationship within the multiple contexts they belong to. The resulting choice is shaped by and also shapes the context in which they belong and their everyday practices through their identity. In this sense, the choices made by the health staff shape issues around what is being communicated, how, by whom, and to whom.

Castells describes identity to play different roles such as legitimizing, resistance, and project, which also has implications on shaping communication processes. The legitimizing role is seen to be hierarchical and power driven, and communication is thus expected to be shaped within this hierarchical and top down structure. In contrast, resistance identity will require the nurturing of more bottom up and horizontal communication processes. A project kind of identity reflects the institutionalization of the communication processes that are created through resistance identity. This will involve the stabilization of new sets of meanings and norms around communication. The frame of reference around networks in enabling reflexivity has implications for shaping communication processes that are multi-directional and horizontal, and not just bottom up or top down.

In my case, the focus is not on the resistance kind of identity as discussed by Castells for example in the context of the Zapatista movement. The focus here is very much around developing and strengthening a kind of informational culture that is improved in quality, wider in terms of its linkages and visibility. This informational culture represents an alternative to the existing one. Through the HISP initiative, attempts are also being made to develop horizontal (across districts) linkages. For example, in Niassa, we tried to implement a "cluster strategy" where a computer is placed in a "hub district," and staff from surrounding districts without computers would come to this hub to enter their data. For reasons described in one of the papers (appendix 5), this strategy has not been wholly successful. However, in future if success is achieved in the cultivation of this alternative culture, and also more effective horizontal and vertical information linkages, there is the potential to create a more coherent "PHC identity," that could resemble more the kind of resistance identity that Castells discusses.

In summary, my conceptualization of the relationship between communication and social identity is summarized in the table 6.1 below. Unpacking of this subtle relationship, I argue, provides for a unique contribution to information systems research.

Table 6.1: Summary of relationship between identity and communication.

Aspects of identity	**Implications on communication**
Perceptual and delineating roles of identity	▪Shapes choices in terms of what is being communicated, how and who, and to whom.
Legitimation, resistance and project identities	▪Shapes legitimation top down hierarchical communication (for example, between province ad district); ▪Shapes the communication within the same level of administrative hierarchy (for example, between health staff of the same district), or across districts or provinces.
Network and frame of reference for shaping reflective processes around identity construction	▪Structured in networks rather than the individual level; ▪ICTs help to strengthen identity by allowing the transmission and sharing and meanings; ▪ICTs help to share of common views, knowledge, and experiences.

6.4. Practical health information systems implementation strategies

In information systems research focused in developing countries there is limited literature related to developing practical implications to support implementation processes. For example, in their study of implementation of Geographical Information Systems (GIS) in India, Sahay and Walsham (1996) describe various “enabling” and “inhibiting” factors identified by researchers with respect to GIS implementation. Inhibiting factors include issues such as poor culture of using maps and weak institutional capacity, enabling conditions identified were the presence of a strong data policy, or the positive role of champions. Sahay and Walsham go on to argue that the mere identification of factors is inadequate as they tend to be decontextualized, and need to be related to contextual conditions.

In the case of this thesis, a key issue concerns the strengthening of the information culture, which is argued to be best approached through taking elements of the existing of “old” and blending it with aspects of the “new” primarily relating to the computerization efforts of the HISP initiative. As has been pointed out through the various examples

earlier, there are a number of positive aspects with respect to the existing information culture. The health staff are seen as being extremely hard working, deeply committed to the cause of the patients, and very ingenious in improvising in emergent conditions. It is this ingenuity and ability to improvise that enables them to complete their required tasks even under conditions of extremely scarce resources and overwork. For example, besides the official reporting routines, lab managers use a locally improvised form to report in more detail, indicating the total number of analysis performed form to report in relation to the type of tests requested (Chilundo 2004). I also found, that when the staff did not have a transport to carry the reports from the district to the province, they would look around and find someone in the community who was heading in the direction of the province, and request them to carry the reports. The lack of printer was compensated by going to the local NGO and using their resources.

However, there are also the not so positive aspects of the existing information culture in the sense of the relative disregard the staff have for the quality of data, and for the timeliness aspect in the transmission of the reports. As discussed in the thesis, the reasons for this are multiple including the existing power structures and the inadequate infrastructure and transportation conditions. A starting normative assumption of the HISP action research initiative is that there are currently aspects of the existing informational culture that are dysfunctional and need to be changed. The action research efforts of software introduction, training and education are thus geared towards these efforts.

A change effort like HISP needs to then consider both the positive and not so positive aspects of the context, and try to blend the “old” and “new” in an effective manner. There is of course no existing set of prescriptions that can be applied to this end, and tensions will be ongoing and maybe even irreconcilable. In chapter three, two sets of tensions had been identified. The first relating to the need to try and be sensitive and maintain the social context (to avoid people reacting negatively to the change in their existing status), while at the same time introducing the change effort. The second tension concerns to try and encourage the local and improvisational practices which are positive in the emergent context, while at the same time introducing structure and a degree of formality in the health information systems through computerization.

Keeping in mind that these tensions are not going to disappear away, I try and identify certain practical implications which try to blend this "old" and "new" with a view to strengthen the informational culture and with it the informational capabilities of the health sector. These practical approaches are focused on the issue of communication. However, rather than treating communication as something that can be unproblematically improved, attention is brought to the social context through situating its relationship with counter networks and social identity. Communication practices relate to more than just the activities around the computer, but needs to be taken in conjunction also with the physical infrastructure conditions (Mosse and Sahay 2005). Communication, not only involves improving the functional aspects of information, but also supports the ritualistic, and symbolic aspects. These is a tendency for computerization efforts, not only within the context of developing countries but also in developed country settings, to focus primarily on the functional aspects, for example, of how time can be reduced to transmit reports between levels, which then ignore the social and individual level functions within the existing social networks. Recognizing that communication is a social act that is deeply embedded and historically shaped, helps to emphasize that redefining communication processes is a complex endeavour, and renders difficult the introduction of new computer-based health information systems (Byrne 2004). Three practical approaches around communication to dealing with this complexity are discussed.

- **Being sensitive to the physical context of communication:** Introduction of ICTs and associated practices often assumes that communication can take place in non co-located settings. In contexts like Mozambique, this is an unrealistic assumption. To give a small but pertinent example, the HISP training was located in a room where the computer was placed, which had been constructed through funding from the Portuguese Co-operation (Portuguese Aid Agency). During training the NEP staff were called to attend a patient or to conduct some administrative tasks. A practical solution to this problem, which seriously affected the training, would have been to do the training in the evenings. Our attempt to do so was achieved, though not completely, because the staff became tired by the evening.

Being sensitive to the physical context of communication strengthens both the ritualistic (the sense of social cohesion and identity of the NEP staff), and the functional aspects of

communication by allowing tasks to be done through face to face communication between the NEP staff, for example to tell where a file is located, while the training was going on. Such an approach tries to blend the best of the "old" and "new" and develop a stronger and hybrid information culture. In this case, the old represents the strong ability of the health staff to conduct multiple tasks in parallel, and which provides the HISP team with the confidence to place the computer in their existing workplace, and conduct training whilst they may also be called upon to simultaneously perform other tasks. The new is represented by the computer systems, the training efforts, and attempts to perform the existing health information systems tasks (and also introduce some new ones like related to statistical analysis) in the existing context. This blending, I will argue can contribute to strengthen the existing information culture and capabilities within the PHC sector.

- **Dealing with the structural constraints that shape communication practices:** The constraints and consequences of the lack of transport and other communication infrastructure have been emphasized in this thesis. In contexts like Mozambique, where even telephone lines do not exist, it is unrealistic to imagine that the report forms can be sent over the Internet. This implies that the physical transportation systems would need to be strengthened if the electronic health information systems are to be made functional. Currently, the problem of delays is contributed to by the paucity of transport, and that the administrative tasks need to be coordinated with the transfer of data. For example, if medicines are to be collected from the province on the 5^{th} of a month, then the transfer of forms also is delayed to that day (instead of being sent on the required first of the month). This creates delays and problems through the whole network. This example raises the need firstly for more effective coordination between the different functions of the health facility so that the overall goals are met. Secondly, alternative arrangements for transportation need to be found, such as through outsourcing of logistics support where a dedicated vehicle can be hired for particular days of the month to transport all the health data from the districts in a province to the provincial head office. In addition to improving the functional aspects of flows, this can also help to reduce some of the burden from the health staff

and allow them to focus on their health care tasks. Similar approaches have been used quite effectively in other developing countries (Macueve 2003).

This example illustrates the use of indigenous and locally relevant approaches to strengthen informational linkages, argued in chapter three to be a key aspect of information culture. Some may argue that in the long run, the infrastructural conditions will be improved, and the Internet will function well. However, it is not only the physical and electronic conditions that are being alluded to, but also the social context. For example, the health staff may prefer instead of sending electronically to take the reports physically to the province as they receive a per-diem for travel. The examples help to highlight the point that developing informational linkages is not only about technology, but also relates to the broader physical and social context.

- **Changing the focus of what is being communicated:** The current focus of what is being communicated is on providing *data* rather than *information* or *knowledge*. The reports carry data, often irrelevant and incomplete, only for purposes of completing the *ritualistic* and symbolic aspects of communication – of a report being needed to be sent every month to the higher level of the hierarchy. This current focus needs to be redefined and forms should carry more useful information or knowledge, i.e. enhancing the functional aspect of communication. This implies the need to firstly, collect data that is relevant for action, and secondly, to combine this data with other data (such as population and map boundaries) to convert the data into health indicators, which is useful information. This exactly is the focus of the HISP approach, and the software has the functional capabilities to do so. However, this has not yet been effectively implemented because of the absence of a strong policy at the Ministry of Health to firstly, re-examine and reformulate the datasets, and secondly, to have indicators to be calculated at the lowest levels and used as a basis for functional action. Such an approach is in contrast to the existing situation where indicators are largely calculated at the level of the Ministry of Health primarily to fulfil symbolic purposes. By shifting the level and purpose of the data collection efforts, if the information can be put to action, useful knowledge will be generated through active reflection on the experience of doing so. Such reflection can be usefully reinforced by enabling more horizontal communication linkages, for example

between different districts where health staff can in workshops reflect and learn from their individual expenses.

Changing the focus of the content of existing reports represents a rather radical change, and introducing more of the "new" at the expense of the old. I argue that such a change is necessary in order to improve the quality of information and also enhance the scope of what is being reported. For example, the current health information system is disaggregated to the district level thus masking the sub-district level situation. This problem technically can be addressed through the HISP software (called DHIS) which allows data to be collected at the lowest level, and provides tools that enable the higher ups to drill down to this level. This feature is important to enhance the visibility and accuracy of information, and helps to strengthen the informational culture and overall capability of the PHC sector.

The three approaches described above adopt different blends of the "old" and "new," where the two tensions described earlier will play out differently, although never fully reconciled. While in different contexts, the specificities of the communication practices supported would differ, a generalizable principle is the need to develop context-sensitive and locally relevant approaches that seek to balance between the old and the new. For example, in contexts where the use of computers may be more prevalent (than in the current case of Mozambique), communication approaches could be built upon the use of electronic mail as a mean to develop informational linkages.

6.5. Conclusions

The thesis has presented an in-depth theoretically informed empirical analysis of efforts to introduce computer-based health information systems in disadvantaged areas of Mozambique. Situated within the action research of the Health Information Systems Program, the research reported in this thesis reflects upon the experiences of working at the micro-level of the health facilities in two districts, and also at the "macro-level" of the national level, and also in various other province and district offices.

The theoretical perspective, inspired within a social theory tradition, has tried to develop a conceptual linkage between the "macro" and the "micro". The macro is represented by the context of the PHC sector in Mozambique characterized by poor financial, technological and human resources, very weak physical infrastructure like roads and transport, and a high disease burden to be dealt with by a very few staff. These macro conditions are not all negative, and they help to create a local potential that is built on the qualities of sharing, hard work, mutual respect, and the ability to improvise in emergent circumstances. These macro conditions are seen to be linked to the micro through the notion of communication practices which includes the everyday processes by which the health information systems are collected, registered, collated, analyzed and transmitted. The macro is reflected and also reflects the micro, for example, how the delays in the transmission of health reports are impeded by the poor infrastructure conditions and also involve the use of improvised practices. Communication practices are thus intertwined with the health information system in a mutually constituted relationship.

In addition to counter networks and communication practices, the third foundation of the theoretical network is provided by the concept of social identity. This concept helps to situate the health staff within multiple groups they are members of, and the norms and values that shape this membership. This sense of identification which the staff have with these groups, provides them with meaning, and the sense of how they should communicate, with whom, why, and when.

Together, the three concepts described above, help to conceptualize the social world of the health staff, and its interaction with the efforts to introduce computer-based health information systems. In different ways, the computerization efforts are seen to reconfigure this social world, and this perception shapes the attitudes and behaviour of the health staff towards the computerization efforts.

These computerization efforts need to be situated within ongoing tensions related to context sensitivity and change, and also the need for structure and to support improvisation. Communication is described as a key process that can help to consider both the positive and negative aspects of these tensions, although not reconcile them. The aim of my analysis was to provide descriptions of meaningful ways to develop communication approaches that are sensitive to the local conditions, such as the physical location of the computers on which the health information systems software is installed, while also trying to find ways to have the computers meaningfully used. The sensitivity is in the form of understanding how the communication processes are structured by the physical location, and how these shape the everyday activities of the health staff in providing care and conducting the administrative tasks. In creating physical settings which disrupt these communication processes, there is the danger of the computerization efforts becoming or being seen as dysfunctional with respect to the existing social world. The challenge then is to find effective ways to blend the old and the new.

Another important issue highlighted through my analysis is that computerization should not only be seen in ways of enhancing functional values, but also with respect to its relation with symbolic and ritualistic roles. For example, various ritualistic practices, such as people getting together at the end of the month, are inherent in the existing social world and also positive in terms of promoting a sense of social solidarity. The computerization efforts thus need to be supportive of some of these ongoing rituals, rather than a priori assuming that these are unproductive or irrational and need to be redefined.

Like all PhD theses, this too suffers from various limitations. For example, my understanding of the relationship between the community and the health staff is rather

"narrow", and is also seen primarily from the perspective of the health staff. This narrow empirical base has weakened my understanding of the dynamics of the community based networks described in this thesis as a key constituent of social identity. Another limitation has been with respect to the action research orientation of the study. Due to the relative poor status of the uptake of the computer-based health information systems in the districts studied, it was not possible to go through all the stages of the action research cycles – diagnosing, action planning, action taking, evaluating and specifying learning – during the course of the research.

Despite these limitations, I argue that this thesis makes a solid contribution to understanding the complexities and challenges of introducing computer-based health information systems in a poor country like Mozambique. The network of theoretical concepts developed in this thesis, and its application for empirical analysis, has implications for use in the study of information systems generally and health information systems more specifically in similar disadvantaged contexts.

REFERENCES

Adams, S. and M. Berg (2004) "The nature of the Net: constructing reliability of health information on the Web", In *Information Technology & People* **17**(2): 150-170.

Allen, J. (2004) "Redefining the network: enrollment strategies in the PDA industry", In *Information Technology & People* **17**(2): 171-185.

Amonoo-Lartson, R., G. Ebrahim, H. Lovel and J. Ranken (1984) *District Health Care: Challenges for Planning, Organisation and Evaluation in Developing Countries*, Macmillan, London.

Archer, M. (1982) "Morphogenesis versus Structuration: On combining structure and action", In *The British Journal of Sociology* **33**(4): 455-483.

Avgerou, C. (2003) The Link Between ICT and Economic Growth in the Discourse of Development. In *The IFIP TC8 & TC9/ WG8.2+9.4 Working Conference on Information Systems Perspectives and Challenges in the Context of Globalization*. M. Korpela, R. Montealegre and A. Poulymenakou (Eds), Athens, Greece**:** 373-386.

Avison, D. and G. Fitzgerald (1995) *Information Systems Development Methodologies, Techniques and Tools*, London, McGraw-Hill.

Awepa (1992) Acordos de Paz. Awepa. Maputo, Moçambique.

Barley, S. (1986) "Technology as an Occasion for Structuring: evidence from observations of CT scanners and the social order of radiology departments", In *Administrative Science Quarterly* **31**: 78-108.

Barry, A. (2001) *Political Machines: Governing a technological society*, London and New York, The Athlone Press.

Baskerville, R. (1999) "Investigating Information Systems with Action Research", In *Communications of The Association for Information Systems* **2**(19).

Beck, U. (1992) *Risk Society - Towards a New Modernity*, London, Sage.

Beck, U., A. Giddens and S. Lash (1994) *Reflexive Modernization: Politics, Tradition and Aesthetics in the Modern Social Order*, Cambridge, Polity Press.

Benbasat, I., D. Goldstein and M. Mead (1987) "The Case Research Strategy in Studies of Information Systems", In *MIS Quarterly* **11**(3): 369-386.

Bezanson, K. and F. Sagasti (1995) The Elusive Search: Development and Progress in the Transition to a New Century. In Proceedings of *Ottawa, Canada: International Development Research Centre and Lima, Peru: GRADE, mimeo*.

Braa, J. and B. Blobel (2003) Strategies for developing Health Information Systems in Developing Countries. In *WITFOR White Book: IFIP World Information Technology Forum*. D. Khakhar (Eds), Laxenburg, Austria, IFIP Press**:** 177-219.

Braa, J. and C. Hedberg (2002) "The Struggle for District-based Health Information Systems in South Africa", In *The Information Society* **18**(2): 113-127.

Braa, J., E. Macome, J. Costa, J. Mavimbe, J. Nhampossa, B. José, A. Manave and A. Sitói (2001) "A Study of Actual and Potential Usage of Information and Communication Technologies at district and provincial levels in Mozambique with a focus on the health sector", In *Electronic Journal of Information System in Developing Countries* **5**(2): 1-29.

Braa, J., E. Monteiro and S. Sahay (2004) "Networks of Action", In *MIS Quarterly* **28**(3): 1-26.

Braa, J. and C. Nermunkh (2000) Health Information Systems in Mongolia: A difficult process of change. In *Information Technology in Context: Studies from the perspective of developing countries*. C. Avgerou and G. Walsham (Eds), Burlington, USA, Ashgate Publishing Company.

Burdsey, D. and R. Chappell (2003) "Soldiers, sashes and shamrocks: Football and social identity in Scotland and Northern Ireland", In *Sociology of Sport Online* **6**(1).

Byrne, E. (2004) A Participatory Approach to the Design of a Child-Health Community-Based Information System for the Care of Vulnerable Children, Ph.D. thesis, Western Cape, Cape Town.

Carey, J. (1989) *Communication as Cultures: Essays on media and society*, New York, Routledge.

Castells, M. (1996) *The Rise of the Network Society, The Information Age: Economy Society and Culture*, Oxford, Blackwell.

Castells, M. (1997) *The Power of Identity, The Information Age: Economy Society and Culture*, Oxford, Blackwell.

Castells, M. (1999) Information Technology, Globalization and Social Development. United Nations Research Institute for Social Development (UNRISD). Geneva**:** Discussion paper N 114.

Castells, M. (2000) "Globalization and Identity in the Network Society: A Rejoinder to Calhoun, Lyon and Touraine", In *Prometheus* **4**: 109-123.

Cecez-Kecmanovic, D. and M. Janson (1999) Communicative Action Theory: An Approach to Understanding the Application of Information Systems. In Proceedings of *10th Australasian Conference on Information Systems ACIS'99*, Wellington, New Zealand.

Chilundo, B. (2004) Integrating Information Systems of Disease-Specific Health Programmes in Low Income Countries: The Case Study of Mozambique, Ph.D. thesis, Faculty of Medicine, University of Oslo, Oslo.

Chilundo, B. and S. Sahay (2004) "Representing the phenomenon of HIV/AIDS in developing countries: a case study from Mozambique", In *Journal of Information Technology for Development (forthcoming)*.

Chilundo, B. and M. Aanestad (2003) Vertical or Integrated Programmes? The consequences for the laboratory information systems in Mozambique. In Proceedings of *the IFIP TC8 & TC9/*

WG8.2+9.4 Working Conference on Information Systems Perspectives and Challenges in the Context of Globalization. Electronic version (Eds Korpela, M., Montealegre, R. and Poulymenakou, A.), Athens, Greece.

CIUEM (2004) Telecentros em Moçambique, Maputo. Available at: http://www.telecentros.org.mz

Comissão Nacional de Política de Informática (2001) Estratégia da Política de Informática de Moçambique. CPI. Maputo, Moçambique.

Conselho de Ministros (2000) Política de Informática. Boletim da República, 49 I serie, 3º suplemento**:** 218-228.

Conselho de Ministros (2001) Plano de Acção da Redução da Pobreza Absoluta. Maputo, Moçambique.

Daft, R. and R. Lengel (1986) "Organizational information requirements, media richness and structural design", In *Management Science* **32**(5): 554-571.

Damian, D., A. Eberlein, M. Shaw and B. Raines (2000) The effects of communication media on group performance in requirements engineering. In Proceedings of *Fourth International Conference on Requirements Engineering (ICRE),* June 19 - 23, Schaumburg, Illinois USA.

Dennis, A. and S. Kinney (1998) "Testing Media Richness Theory in the New Media: The Effects of Cues, Feedback, and Task Equivocality", In *Information Systems Research* **9**(3): 256-274.

Dgedge, M., J. Chabot, J. Koot, A. Mussa and L. Zuidberg (2003) Second Joint Evaluation of Health Sector Performance in Mozambique During 2002. Ministry of Health. Maputo.

D'Mello, M. (2003) Thinking Local, Acting Global: Issues of Identity and Related Tensions in Global Software Organizations in India. In Proceedings of *IFIP 8.2+9.4 Working Conference on Information Systems Perspectives and Challenges in the Context of Globalization. Electronic version (Eds Korpela, M., Montealegre, R. and Poulymenakou, A.),* Athens, Greece.

DuBois, M. (1991) "The Governance of the Third World: A Foucauldian Perspective on Power Relations in Development", In *Alternatives* **16**: 1-30.

Eden, C. and C. Huxham (1991) "Action Research for Management Research", In *British Journal of Management* **7**: 75-86.

EDI (1996) Reprioritizing Public Health Resources Toward Primary Health Care in Mozambique. In *Sustainable Health Care Financing in Southern Africa*. A. Beattie, J. Doherty, L. Gilson, E. Lambo and P. Shawv (Eds), Johannesburg, EDI Learning Resources Series**:** 137-145.

Escobar, A. (1995) *Encountering Development: The Making and Unmaking of the Third World*, Princeton, New Jersey, Princeton University Press.

Esteva, G. (1987) "Regenerating People's Space", In *Alternatives* **10**(3): 125-152.

Falck, H., K. Landfald and P. Rebelo (2003) "Mozambique", In *Development Policy Review* **21**(2): 235-252.

Faraj, S., D. Kwon and S. Watts (2004) "Contested artifact: technology sensemaking, actor networks, and the shaping of the Web browser", In *Information Technology & People* **17**(2): 186-209.

Feldman, M. and J. March (1981) "Information in Organizations as Signal and Symbol", In *Administrative Science Quarterly* **26**(2): 171-186.

Fook, J. (2002) *Social Work: Critical Theory and Practice*, London, Sage Publications.

Fraser, N. (1993) Rethinking the Public Sphere: A Contribution to a Critique of Actually Existing Democracy. In *Habermas and the Public Sphere*. C. Calhoun (Eds), Cambridge, MIT Press**:** 142-163.

Fulk, J. (1993) "Social construction of communication technology", In *Academy of Management Review* **36**(5): 921-951.

Galblum, A. (2002) Health information project: using handled computers for surveys. *International Institute for Communication and Development*. Available at: www.iicd.org

Galbraith, J. (1973) *Designing Complex Organizations*, Addison-Wesley, Reading Mass.

Giddens, A. (1984) *The Constitution of Society*, Cambridge, Polity Press.

Giddens, A. (1991) *Modernity and Self-Identity: Self and Society in the Late Modern Age*, Cambridge, Polity Press.

Giddens, A. and C. Pierson (1998) *Conversations with Anthony Giddens*, Cambridge, UK, Polity.

Gomes, A. and K. Johnson (1994) Creation of a centralized health data bank for Mozambique: Feasibility study report. Maputo.

Governo de Moçambique (2000) Plano Quinquenal do Governo. official publication. Maputo, Mozambique.

Green, M. (2002) Social Development: Issues and Approaches. In *Development Theory and Practice: Critical Perspectives*. U. kothari and M. Minogue (Eds), Palgrave**:** 52-70.

Habermas, J. (1984) *Theory of Communicative Action 1*, Boston, MA, Beacon Press.

Hall, S. (1996) Cultural Studies: Two Paradigms. In *What is Cultural Studies*. J. Storey (Eds), London, Arnold**:** 31-48.

Hanseth, O. and E. Monteiro (1997) "Inscribing behavior in information infrastructure standards", In *Accounting Management and Information Technologies* **7**(4): 183-211.

Hanseth, O., M. Aanestad and M. Berg (2004) "Actor-network theory and information systems. what's so special?" In *Information Technology and People* **17**(2): 116-123.

HDR (1999) Globalization with human face, United Nations Development Program.

HDR (2000) *Human Development and Human Rights*, New York, United Nations Development Program, Oxford University Press.

HDR (2004) Cultural Liberty and today's diverse world, United Nations Development Program.

Heeks, R. (1998) Information Age Reform of the Public Sector: The Potential and Problems of IT for India. *Information Systems for Public Sector Management Working Paper Series, Working Paper No. 6*, Manchester, IDPM, University of Manchester. Available at: http://idpm.man.ac.uk/publications/wp/igov/igov_wp06.pdf

Heeks, R. (2002) "Information Systems and Developing Countries: Failure, Success and Local Improvisations," In *The Information Society* **18**(2): 101-112.

Heeks, R., D. Mundy and A. Salazar (1999) "Why Care Information Systems succeed or fail", In *Institute for Development Policy Manchester (IDPM)*(Working Paper No. 9).

Heng, M. and A. De Moor (2003) "From Habermas's communicative theory to practice on the internet", In *Information Systems Journal* **13**: 331-352.

Heracleous, L. and J. Hendry (2000) "Discourse and the study of organization: Toward a structurational perspective", In *Human Relations* **53**(10): 1251-1286.

Hirschheim, R. and H. Klein (1989) "Four Paradigms of Information Systems Development", In *Communications of the ACM* **32**(10): 1199-1215.

INE (1999) Projecções Anuais da População Total, 1997-2020. Maputo: INE, Série Estudos Nº1.

Jamisse, L., F. Songane, A. Libombo, C. Bique and A. Faundes (2004) "Reducing maternal mortality in Mozambique: challenges, failures, successes and lessons learned", In *Gynecology & Obstetrics* **85**: 203-212.

Jones, M. and H. Karsten (2003) Review: Structuration theory and information systems research. W. 11/2003. Cambridge, University of Cambridge.

Jonsson, S. (1991) Action Research. In *Information Systems Research: Contemporary Approaches and Emergent Traditions*. H.-E. Nissen, H. K. Klein and R. Hirschheim (Eds), Elsevier Science Publishers B. V. (North-Holland)**:** 371-396.

Joshi, P. (1991) "Communication and Social Change", In *Social Action* **41**(2): 121-155.

Kallinikos, J. (2003) Networks as Alternative Forms of Organization: Some Critical Remarks. In Proceedings of *11th European Conference in Information Systems, New Paradigms in Organizations, Markets and Society*, Napoli.

Kimaro, H. and J. Nhampossa (2005) "Analysing the problem of unsustainable health information systems in low income countries: case studies from Tanzania and Mozambique", In *Information Technology for Development*(Forthcoming).

Kling, R. (1987) Defining the boundaries of computing across complex organizations. In *Critical issues in Information Systems Research.* R. Boland and R. Hirschheim (Eds), Chichester, John Wiley & Sons.

Kling, R. (1990) Information Systems, Social Transformations, and Quality of Life. In Proceedings of *ACM SIGCAS Computers and Society, Proceedings of the Conference on Computers and the quality of life*, George Washington University, Washington, DC, USA.

Kling, R. and W. Scacchi (1982) "The Web of Computing: Computer Technology as Social Organizations", In *Advances in Computers* **21**: 1-90.

Kluzer, S. (1993) The Political Economy of IT in Sub-Saharan Africa: The Diffusion of Computers in Mozambique, Ph.D. thesis, LSE, University of London, London.

Knorr-Cetina, K. and U. Bruegger (2002) "Traders' Engagement with Markets: A postsocial relationship", In *Theory, Culture and Society* **19**(5/6): 161-185.

Lash, S. (1994) Reflexivity and its doubles: structure, aesthetics, community. In *Reflexive Modernization: Politics, Tradition and Aesthetics in the Modern Social Order*. U. Beck, A. Giddens and S. Lash (Eds), Cambridge, Polity Press**:** 110-173.

Lee, A. (2001) "Editorial", In *MIS Quarterly* **25**(1): iii-vii.

Levin, M. (1994) "Action Research and Critical Systems Thinking: Two Icons Carved Out of the Same Log?" In *Systems Practice* **7**(1): 25-41.

Lindelow, M. (2002) Health Care demand in rural Mozambique: Evidence from the 1996/97 household survey. *Food Consumption and Nutrition Division (FCND).* Available at: http://www.ifpri.org/divs/fcnd/dp/papers/fcndp126.pdf

Lippeveld, T., R. Sauerborn and C. Bodart (2000) *Design and Implementation of Health Information Systems*, Washington, DC, World Health Organization.

Lyytinen, K. and R. Hirschheim (1988) "Information systems as rational discourse: An application of Habernas' theory of communication action", In *Scandinavian Journal of Management* **4**: 19-30.

Lyytinen, K. and H. Klein (1985) The critical theory of Jurgen Habermas as a basic for a theory of information systems. In *Research Methods in Information Systems*. E. Mumford, R. Hirschheim, G. Fitzgerald and T. Wood-Harper (Eds), New York, North Holland**:** 219-236.

Lyytinen, K. and O. Ngwenyama (1992) "What does computer support for cooperative work mean? A structurational analysis of computer supported cooperative work", In *Accounting, Management and Information Technologies* **2**(1): 19-37.

Macome, E. (2003) The dynamics of the adoption and use of ICT-based initiatives for development: results of a field study in Mozambique, Ph.D. thesis, Faculty of Engineering, University of Pretoria, Pretoria.

Macueve, G. (2003) Drugs logistics management information system in Mozambique: Challenges and Opportunities, Master thesis, Department of Informatics, University of Oslo, Oslo.

Madon, S. (2000) "The Internet and Socio-economic development: exploring the interaction", In *Information Technology and People* **13**(2): 85-101.

Mansell, R. and U. Wehn (1998) *Knowledge Societies: Information Technology for Sustainable Development*, Oxford University Press.

Markus, L. (1994) "Electronic mail as the medium of managerial choice", In *Organization Science* **5**(4): 502-527.

Marres, N. (2004) "Tracing the trajectories of issues, and their democratic deficits, on the Web: The case of the development gateway and its doubles", In *Information Technology & People* **17**(2): 124-149.

Mejias, R., J. Palmer and M. Harvey (1999) "Emerging technologies, IT infrastructure, and economic development in Mexico", In *Journal of Global Information Technology Management* **2**(1): 31-54.

Miles, M. and A. Huberman (1994) *Qualitative Data Analysis*, Newbury Park, CA, Sage, (2nd edition).

Ministério da Saúde (1979) *Cuidados de Saúde Primários em Moçambique*, Maputo, Ministerio de Saude.

Ministério da Saúde (2001) Plano Estratégico do Sector de Saúde (PESS) 2001 - 2005 - (2010). Maputo.

Monteiro, E. and O. Hanseth (1995) Social shaping of information infrastructure: on being specific about the technology. In *Information technology and changes in organisational work*. W. Orlikowski, G. Walsham, M. Jones and J. DeGross (Eds), London, Chapman & Hall**:** 325 - 343.

Mosse, E. and P. Nielsen (2004) "Communication Practices as Functions, Rituals and Symbols: Challengers on computerization of paper-based information system", In *Electronic Journal for Information Systems in Developing Countries* **18**(3): 1-17.

Mosse, E. and S. Sahay (2001) Counter Networks and Social Exclusion: The case of Health Information in Mozambique. In Proceedings of *Information Systems Research Seminar in Scandinavia (IRIS 24)*, Ulvik in Hardanger, Norway.

Mosse, E. and S. Sahay (2003) Counter Networks, Communication and Health Information Systems: A Case Study from Mozambique. In *The IFIP TC8 & TC9/ WG8.2+9.4 Working Conference on Information Systems Perspectives and Challenges in the Context of Globalization.* M. Korpela, R. Montealegre and A. Poulymenakou (Eds), Athens, Greece**:** 35-51.

Mosse, E. and S. Sahay (2005) "The Role of Communication Practices in the Strengthening of counter Networks: Case experiences from the health sector of Mozambique", In *Information Technology for Development*(Forthcoming).

MPF and MISAU (2004) A Despesa Pública e a Prestação de Serviços na Saúde em Moçambique: Uma Síntese. Maputo, Ministério do Plano e Finanças e Ministério da Saúde.

MPF and MISAU (2004a) *A Despesa Pública com a Saúde em Moçambique*, Principia, Publicações Universitárias e Científicas.

Murray, C. and J. Frenk (2000) "A framework for assuring the performance of health systems", In *Bulletin of the World Health Organization* **78**(6): 717-731.

Mwaluko, G., D. Neuvians and B. Pazvakavambwa (1996) Health Sector Reforms in Eastern and Southern Africa: A Training Manual for District Health Workers.

Myers, M. and D. Avison (2002) An introduction to qualitative research in information systems. In *Qualitative Research in Information Systems: A Reader*. M. D. Myers and D. E. Avison (Eds), London, Sage.

Måhring, M., Holmstrom, M. Keil and R. Montealegre (2004) "Trojan actor-networks and swift translation: Bringing actor-network theory to IT project escalation studies", In *Information Technology & People* **17**(2): 210-238.

Ngwenyama, O. and A. Lee (1997) "Communication richness in electronic mail: Critical social theory and the contextuality of meaning", In *MIS Quarterly* **21**(2): 145-167.

Noormahomed, A. and M. Segall (1994) The Public Health Sector in Mozambique: A post-war Strategy for Rehabilitation and Sustained Development,. World Health Organization, "Macro Economics, Health and Development", Series 14. Geneva**:** 94 pp.

Odedra, M., M. Lawrie, M. Bennett and S. Goodman (1993) "Sub-Saharan Africa: A Technological Desert", In *Communication of the ACM* **36**(2): 25-29.

Opit, L. (1987) "How should information on health care be generated and used?" In *World Health Forum* **8**: 409-417.

Orlikowski, W. (1993) "CASE tools as organizational change: investigating increment and radical changes in system development", In *MIS Quarterly* **17**(3): 309-340.

Orlikowski, W. and J. Baroudi (1991) "Studying Information Technology in Organizations: Research Approaches and Assumptions", In *Information Systems Research* **2**(19): 1-28.

Orlikowski, W. and D. Robey (1991) "Information technology and the structuring of organizations", In *Information Systems Research* **2**(2): 143-169.

Orlikowski, W. and J. Yates (1994) "Genre reportoire: The structuring of communicative practices in organizations", In *Administrative Science Quarterly* **39**(4): 541-574.

Orlikowski, W. and J. Yates (2002) "It's About Time: Temporal Structuring in Organizations", In *Organization Science* **13**(6): 684-700.

Orlikowski, W. J. (1991) "Integrated information environment or matrix of control? the contradictory implications of information technology", In *Accounting, Management and Information Technology* **1**(1): 9-42.

Orlikowski, W. J. (1992) "Learning from Notes: organizational issues in groupware implementation", In *CSCW '92*: 362 - 369.

Pavignani, E. and A. Colombo (2001) Providing health services in countries disrupted by civil wars: A comparative analysis of Mozambique and Angola 1975-2000. World Health Organization.

Peirce, B. (1995) "Social identity, investment, and language learning", In *TESOL Quarterly* **29**(1): 9-31.

Pettigrew, A. (1987) "Context and Action in the Transformation of the Firm", In *Journal of Management Studies* **24**(6): 649-670.

Puri, S. (2003) The Challenges of Participation and Knowledge in GIS Implementation for Land Management: Case Studies from India, Ph.D. thesis, Department of Informatics, University of Oslo, Oslo.

Puri, S., E. Byrne, J. Nhampossa and Z. Quraishi (2004) Contextuality of Participation in IS Design: A Developing Country Perspective. In Proceedings of *Artful integration: interweaving media, materials and practices*, Toronto, Canada.

Rogers, M. (1995) *Diffusion of Innovations*, New York, The Free press.

Room, G. (1995) *Beyond the Threshold: The Measurement and Analysis of Social Exclusion*, Bristol, UK, The Polity Press.

Sachs, W. (1992) Introduction. In *The Development Dictionary. A guide to knowledge as power*. W. Sachs (Eds), London, Zed Books**:** 1-5.

Sahay, S. (2003) "Global software alliances: the challenge of 'standardization'", In *Scandinavian Journal of Information Systems* **15**: 3-21.

Sahay, S. (2004) "Beyond Utopian an Noslatgic Views of Information Technology and Education: Implications for Research and Practice", In *Journal of the AIS* **5**(7).

Sahay, S. and C. Avgerou (2002) "Introducing the Special Issue on Information and Communication Technologies in Developing Countries", In *Information Society* **18**(2): 73-76.

Sahay, S., B. Nicholson and S. Krishna (2003) *Managing Global Software Alliances*, Cambridge, Cambridge University Press.

Sahay, S. and D. Robey (1996) "Organizational context, social interpretation, and the implementation and consequences of geographic information systems", In *Accounting Management and Information Technologies* **6**(4): 255-282.

Sahay, S. and G. Walsham (1996) "Implementation of GIS in India: Organizational Issues and Implications", In *International Journal of Geographic Information Systems* **10**(4): 385-404.

Sahay, S. and G. Walsham (1997) The Use of Geographic Information Systems in Developing Countries: Social and Management Issues. International Centre for Science and High Technology, and the United Nations Industrial Development Organization. Vienna.

Sein, K. and G. Harindranath (2004) "Conceptualizing the ICT Artifact: Toward Understanding the Role of ICT in National Development", In *The Information Society* **20**(1): 15-24.

Sen, A. (1998) Social exclusion and macro economic measurement. In Proceedings of *The 25th General Conference of the International Association for the Research in Income and Wealth*, Cambridge, UK.

Sen, A. (1999a) *Development as Freedom*, Oxford, Oxford University Press.

Sen, A. (1999b) *Reason Before Identity*, New Delhi, Oxford University Press.

Shannon, C. and W. Weaver (1949) *The Mathematical Theory of Communication*, University of Illinois Press.

Sheer, V. and L. Chen (2004) "Improving Media Richness Theory: A Study of Interaction Goals, Message Valence, and Task Complexity in Manager-Subordinate Communication", In *Management Communication Quarterly* **18**(1): 76-93.

Silva, L. and E. Figueroa (2002) "Institutional intervention and the expansion of ICTs in Latin America", In *Information Technology and People* **15**(1): 8-25.

Suchman, L. (1987) *Plan and Situated Action: The problem of Human Machine Communication*, Cambridge, Cambridge University Press.

Suchman, L. (2002) "Practice-Based Design of Information Systems: Notes from the Hyperdeveloped World", In *The Information Society* **18**(2): 139-144.

Susman, G. and R. Evered (1978) "An Assessment of the Science Merits of Action Research", In *Administrative Science Quarterly* **23**: 582-603.

Tajfel, H. (1972) Experiments in a vacuum. In *The Context of Social Psychology: A Critical Assessment*. J. Israel and H. Tajfel (Eds), London, Academic Press.

Tajfel, H. and J. Turner (1979) An Intergrative Theory of Intergroup Conflict. In *The Social Psychology of Intergroup Relations*. W. Austin and S. Worchel (Eds), CA, Monterey, Brooks/Cole**:** 33-47.

Tanno, D. and A. Gonzalez,(Eds) (1998) Communication and Identity across cultures. California, Sage Publications.

Thompson, M. (2002) "Cultivating meaning: interpretive fine-tuning of a South African health information system", In *Information and Organization* **12**(2): 183-211.

Thompson, M. and G. Walsham (2001) Learning to value the bardic tradition: Culture, Communication and Organizational Knowledge. In Proceedings of *The 9th European Conference on Information Systems*, Bled, Slovenia.

UNDP (2001) Creating a Development Dynamic: Final Report of the Digital Opportunity Initiative, Accenture MARKLE FOUNDATION UNDP.

Universidade Eduardo Mondlane (1989) Presente e Perspectivas. EMU. Maputo, Mozambique.

Van Diesen, A. (1999) Aid to Mozambique: An End to Dependence? *Christian Aid*, London. Available at: http://www.searchweb.com/

Walsham, G. (1993) *Interpreting Information Systems in Organizations*, Chichester, John Wiley & Sons.

Walsham, G. (1995a) "The Emergence of Interpretivism in IS Research", In *Information Systems Research* **6**(4): 376-394.

Walsham, G. (1995b) "Interpretive case studies in IS research: nature and method", In *European Journal of Information Systems* **4**: 74-81.

Walsham, G. (1997) Actor-Network Theory and IS Research: Current status and future prospects. In Proceedings of *IFIP Working Group International Conference on Information Systems and Qualitative Research*, Chapman and Hall.

Walsham, G. (2000) IT, Globalisation and Cultural Diversity. In *Information Technology in Context: studies from perspective of developing countries*. C. Avgerou and G. Walsham (Eds)**:** 291-303.

Walsham, G. (2001) *Making a World of Difference: IT in a Global Context*, Chichester, John Wiley & Sons.

Weick, K. (1979) *The Social Psychology of Organizing*, Addison-Wesley, Reading Mass.

Westrup, C. (1996) "The play of information system development: Drama and ritual in the development of a nursing information system", In *Information Technology and People* **9**: 24-42.

WHO/UNICEF (1978) Health for All. Alma Ata, URSS, World Health Organization (WHO).

WHR (2004) Changing History. Geneva, World Health Organization.

Windhal, S., B. Signitzer and J. Olson (1992) *Using communication theory: An introduction to planned communication*, London, Sage Publications.

World Bank (2004) Social Development in World Bank Operations: Results and Way Forward, discussion document. Available at: http://lnweb18.worldbank.org/ESSD/sdvext.nsf/62ByDocName/SocialDevelopmentinWorldBankOperationsResultsandaWayForward/$FILE/SDStrategy-Final+2-06-04.pdf

Yates, J. (1989) *Control through Communication: The Rise of System in American Management*, London, The Johns Hopkins University Press Ltd.

Yin, R. (1994) *Case Study Research: Design and Methods*, Thousands Oaks, CA, USA, Sage Publications.

Zuboff, S. (1988) *In the age of smart machine*, Oxford, Heinemann.