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COUNTER NETWORKS, COMMUNICATION AND HEALTH INFORMATION SYSTEMS
A Case Study from Mozambique

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Abstract: Mozambique, actively trying to deploy ICTs like many developing countries, faces critical problems in providing health care services to its population, especially those living in rural areas. These attempts are extremely complex due to a variety of constraints ranging from inadequate infrastructure to manpower shortages, to a culture that does not yet value the "efficient use of information." In this paper, we unpack the relationship between communication practices and health information flows within the context of the primary health care system of Mozambique, and argue that understanding this relationship is crucial for developing context-sensitive approaches to implementing computer-based health information systems. Through an empirical analysis of ongoing efforts in a health district within the Health Information System Program (HISP), we seek to understand the communication practices which surround processes of collection, analysis and transmission of health data up and down the various levels of the health administration hierarchy. The nature of these communication practices has a visible impact on the quality, timeliness and usage of health data. The paper describes the functioning of the health information system as a network comprising multiple human and non-human actors within deep-rooted socio-cultural structures. Inspired by Castells, we examine how understanding the reciprocal relationships between communication practices and health information can help to develop "counter networks" to provide hitherto marginalized groups and regions in the potential access to "network society."

Keywords: Information and communication technologies, Health information systems, Mozambique, Actor-Network Theory, Network Society, work practices.

1 INTRODUCTION

Mozambique, like many other developing countries, has in recent years been attempting to introduce information and communication technologies (ICTs) in various sectors to promote socio-economic development. One important sector is health, especially in the domain of primary health. These ICT initiatives take place in a context that is historically and culturally shaped; the socio-cultural structures are reflected in patterns of how work is currently done. The work practices and existing communication practices that surround the collection, storage, transmission and analysis of routine health data, particularly within the district health level, are often in tension with those assumptions inscribed in the technology and proposed management methods of work. Understanding the nature of these tensions is crucial for the planning of new ICT implementations, and this requires understanding local improvisations and work practices, and how these can be more effectively integrated (see e.g. Sahay and Avgerou, 2002). The informal and locally improvised ways in which communication takes place is often in direct tension with the conditions and implicit assumptions made for the implementation of ICT initiatives like the Health Information System Program (HISP) that is described in this paper.

The paper is organized as follows. In the next section, we outline our conceptual approach to the study of communication, and analyze its role in the creation of "counter networks". Following this, we provide some details of the context of the Mozambique health system and the ongoing HISP, which is the basis of the empirical study. In Section 4, based on the empirical work within the health district of Xai-Xai, we describe the communication practices that surround the health information flows. In Section 5, we analyze the case material based on key concepts from Actor-Network Theory and the concept of counter networks. This analysis helps us to develop some implications for the implementation of HISP. Finally, we draw some concluding remarks arising from the study.

2 COMMUNICATION PRACTICES AND "COUNTER NETWORKS"

In discussion below, we outline our conceptual approach to the study of communication, and relate it to the metaphor of "counter networks." Drawing from Castells (1996; 2000), "counter networks" is an analytical concept that we propose to help analyze the nature of communication practices at district level, and relate it to the HISP implementation.

Our interest is to understand how communication practices both constitute and are constituted in the flows of health information. By health information flows, we refer to the flow of health data from the community to the district, to the province and to national levels of the health administrative hierarchy in Mozambique.

We take an interpretive research approach to analyze health information flows in the context of the socio-cultural processes that surround their construction and use, seen from a social systems perspective. Interpretive research is concerned with developing a deep and contextual understanding of the phenomenon. We focus on the subjective processes that surround the social construction of communication practices understood through the use of qualitative research methods (Walsham, 1993; Martin and Nakayama, 1999). The aim of such interpretive analysis is to understand rather than to predict behavior. We seek to understand "communication practices in context", where the context is a health district of Mozambique. These practices relate to how health data are collected, their storage, analysis, and transmission up and down the different levels of the administrative hierarchy. These practices involve people, their meetings and conversations with others, their physical movements to circulate information, their use of various forms of artifacts, such as book registers and forms, and current attempts to apply ICTs. These social interactions are regulated by the formal requirements of the health information systems (for example, to submit monthly reports) and are enacted in the everyday life of health staff often in informal and locally improvised ways. The interpretive perspective helps to focus on these formal and informal communication practices that surround, and are constituted in the flow of health information in the particular context of a health district. Such an approach implies an epistemology that assumes the social construction of knowledge and reality (Walsham, 1995).

Communication practices are conceptualized as being mutually constituting and constituted by health information flows, implying that they shape and are also shaped by health information flows. For example, the ways data are collected, stored and transmitted reflect how people communicate with each other, how they use artifacts, and how these information flows are shaped through these communication practices. This reciprocal relationship implies a structurational process (Giddens, 1984), which Yates and Orlikowski (1992) draw upon in their study of "genres of communication." Our emphasis on the socio-cultural context within which communication is shaped implies that health information flows are intricately tied up with questions of identity (Amant, 2002), the context of communication (Hall, 1983), and the norms and meanings that shape social interaction (Yates and Orlikowski, 1992).

Our empirical analysis aims at unpacking the mutual relationship between health information flows and communication in a Mozambican

health district, with a view to understand the nature of communication practices and their relation with HISP. Developing such a subtle understanding of this relationship, we believe, creates the potential to develop meaningful implications for a more context sensitive implementation approach. We see the unfolding of these communication practices as crucial to the development of the notion of "counter networks", as a metaphor to emphasize those people, regions and sectors who for reasons of history, geography, economic resources and knowledge have been excluded from formal networks, as reflected in notions of the "global village" and "information society".

Our usage of the term "counter networks" draws its inspiration from Castells' (1996) discussion of globalization processes in the "network society". Castells argues that groups and also regions that have been historically excluded and marginalized, for example the primary health care (PHC) sector in a developing country like Mozambique, run the risk of being systematically marginalized in the future if they are not able to "link up" (using the power of new ICTs) with ongoing processes of globalization that provide them greater potential access to funds, new knowledge, and a broader visibility. However, this networking is problematic to achieve in practice due to historical reasons such as the inadequate infrastructure and capacity of people to engage with new technologies and forms of knowledge. Thus building these "counter networks" can be viewed metaphorically as a deliberate attempt to try and transcend existing inhibiting conditions, in order to include marginalized entities, such as the primary health care sector, in a broader "network of flows". Castells sees ICTs as a fundamental tool to enable these networking processes. An important aspect of "counter networking", we argue, rests in the understanding of locally constructed communication practices, and analyzing approaches by which they can be seriously "taken into account" by ICT initiatives like HISP.

HISP is an initiative aimed at computerization of PHC processes in developing countries, including Mozambique, in selected health districts. HISP was initiated in South Africa in 1995, and now represents a collaborative research and development program between University of the Western Cape and University of Cape Town (South Africa), University of Oslo (Norway), Universidade Eduardo Mondlane (Mozambique) and the ministries of health of South Africa and Mozambique. Within this research program, HISP has developed a free open source software application – District Health Information System (DHIS) database, based on MS Access and designed for data collection, analysis and reporting. The aim of HISP is to develop health information systems to support the emerging decentralized health administrative structures in various developing countries (Braa and Hedberg, 2002). The broader agenda of HISP is to enable local control of

health information at the district and sub-district levels and thus to empower local users to have greater control of their work processes. Typically in most developing countries, the existing situation of collected health data is that it is sent to higher levels for analysis and reporting rather than being used to support local action (Wilson et al., 1989; Opit, 1987). HISP seeks to introduce computers at the district levels as contrasted to the existing focus of computerization at the province and national levels. By placing computers at the district and through training of the district staff, HISP seeks to redress this current imbalance in focus and encourage the local analysis and use of information to support health care in peripheral areas. However, bringing about this change in practice is an extremely complex and long-term task. One of the reasons for this is the nature of existing systems of communication, which we argue are in tension with the assumptions inscribed in efforts like HISP. We discuss some of these issues in the case description below.

3   RESEARCH SETTING

The research is set in Mozambique, a country situated in Southern Africa, with a total area of 801,590 square kilometer, and divided into eleven provinces, which are further subdivided into a total of 131 districts. The current population of the country is estimated at 19 million, of which more than half are under 20 years old and more than 60% are illiterate. The growth rate of Mozambique is estimated at 1.1% (Census, 1997) with a population density of 20 persons per square kilometer. The population is predominantly rural; the urban population is estimated at only 13%. The extensive rural spread of the population, a condition magnified by nearly two decades of devastating civil war (1976 - 1992) that destroyed large portions of the communication and physical infrastructure (including roads, telephone lines, and health facilities) has meant that access to health care services for the majority of people is problematic. For all these reasons many of the rural communities have existed in "isolation", devoid of active contact with the formal governmental systems. This isolation has seriously affected all aspects of socio-economic development processes, effects of which are still being felt, for example in the provision of health care. The low levels of literacy and nearly non-existent computer literacy especially in the rural areas, make the introduction of any form of ICT-based systems a herculean task. To enable these historically excluded and marginalized regions to become part of larger globalization processes is not a task of "simply technically plugging in the computers", but requires a strategy for the systematic construction of "counter networks", that takes into serious consideration the existing socio-cultural conditions.

We discuss one such attempt of counter networking in HISP within the PHC domain, a sector that has attracted insignificant amounts of funding and attention as compared to the hospital system or the private health care sector. We first discuss the overall structure of health organization of Mozambique. Set within this broader context, we provide details of our empirical work at the micro level of the health districts.

3.1   Health System Organization

Mozambique has adopted the Primary Health Care (PHC) approach of the World Health Organization (WHO, 1978) in an attempt to have a direct and positive impact on the communities through the expansion of health services. This PHC approach has been argued to be effective for the provision and organization of health care services in developing countries (Amonoo et al., 1984; Newell, 1989). After Mozambique became independent in 1975, the number of health facilities was greatly expanded in all regions, a trend which still continues (Roemer, 1992). The health information system (HIS) of Mozambique has been described as being primarily top-down, implying that while planning and implementation of health systems start at the level of the central Ministry of Health, MISAU[1], health data are collected at the local community level and sent up to the ministry (Braa et al., 2001). Feedback from MISAU to the local levels is limited, and data collection and its upward transmission are seen to reflect the existing hierarchical organizational structure (Jeremias and Sitói, 1997) across four levels: community, district, province and national (see Figure 1). The Mozambique health system employs a total of about 17.000 people, of which approximately 400 are medical doctors, 9500 are health technicians, and the remaining are administrative staff.
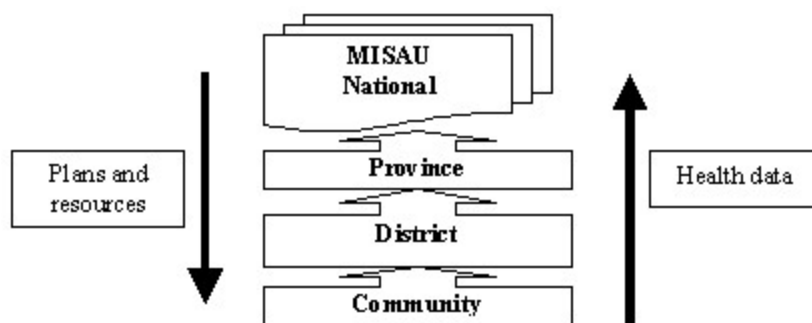

Figure 1. Health system organization in Mozambique

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[1] Ministério de Saúde

The community level is important for providing basic care, and there have been positive experiences in the participation and involvement of community groups such as non-governmental organizations (NGO) and Agentes Polivalentes Elementares (APEs[2]) in the management of services and health programs. Within the community level, health centers and health posts (health units) are responsible for the provision of PHC services, and also for the collection of health data in various forms and its transmission to the next level, the district. At the community level, data related to a patient (for example, a pregnant woman) are first entered in register books and tick registers, and at the end of the month are summarized and sent to the district, indicating the number of patients seen in each health unit, and categorized by disease. The people involved in this process of health data transactions are mainly health personnel with limited formal medical training. Among factors inhibiting the effective transmission of data to the higher levels are physical distance, poor transportation connections, and time pressures experienced by health workers. The poor communication that results from these conditions contributes to incomplete, untimely and often incorrect transmission of health data.

The next level is the district, which consists of a network of health units, responsible for the management of health care in its jurisdiction. The most important authority in this network is the district health office, DDS[3] that is responsible for the overall administration, planning, and implementation of the health services. With respect to health data, the DDS is responsible for the aggregation of all the data received from health units within the district, and its transmission to the province. In addition to the data from health units, the DDS also works with NGOs, such as World Vision and Save the Children, which operate within the district. The province is responsible for sending monthly report to MISAU, based on further aggregation of the health data from the provincial districts.

For this discussion the community and the district levels are the most important. We now describe the case study at the micro level of analysis of communication practices.

4   THE CASE STUDY

The study was carried out in the health district of Xai-Xai. In Table 1 below, we provide an overview of the number and qualifications of personnel that work in the health district of Xai-Xai. A quick glance at the

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[2] An APE is a person trained for a few months to provide first aid in the community, usually where there is no health unit.
[3] Direcção Distrital de Saúde

table indicates how understaffed the facility is and also the low educational skill level. The level of health personnel in the district varies from Medical Doctor to "Servant". Besides the doctor, the education level of the people running the health units is mostly limited to elementary or primary school.

Table 1. Number and educational level of personnel in Xai-Xai health district[4].

Position	HC Chicumbane and RH Chicumbane	HC Maciene	HP Siaia	HP Chongoene	HP Nhancutse	HP Chilaulene	HP Zonguene	HP V. Lenine	HP Chipenhe	HP J. Nyerere	HP Banhine	HP Nhamavila
Medical Doctors	1											
Pré-Universitário	5	1										
Básico	25	1	2	1	1		1	2	2	2		1
Elementar	4	3		1		2	1				1	
Servant	15	7		2	1	1	1	1	1	1	1	1
Other	9	3	1		1							
Total	**59**	**15**	**3**	**4**	**3**	**3**	**3**	**3**	**3**	**3**	**2**	**2**

The rural hospital in Xai-Xai has 93 beds, caring for approximately 200 inpatients per month, and provides several forms of primary health care. The health centre is responsible primarily for the provision of the Extended Immunization Program (PAV) and Mother and Child (SMI) programs. The personnel responsible for these programs comprise the core planning team, NEP[5] responsible for both the entire district and the health center.

Field research was conducted through detailed participant observation and interviews with key actors during the period of April to June 2002, with follow up research during 2003. The interviews were conducted with 13 key people engaged with processes of health information systems across three levels, specifically the community, district (DDS) and the province. Two of the DDS staff was interviewed three times each. The aim of the field research efforts was to understand the functioning of the HIS in this particular setting and to determine constraints to the processes of health data collection, storage, transmission and analysis. The interpretive research approach adopted helped us in understanding how people create and associate their subjective and inter-subjective meanings in their interactions with the world around them during the course of their everyday work practices (Walsham, 1993). In addition to the interviews, we were also

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[4] Pré-Universitário refers to completion of "high school" (12 years). Básico refers to 10 years of education, while elementar refers to 7 years of education completed.
[5] Núcleo de estatística e planificação

actively engaged in providing training to the NEP staff on the use of the HISP DHIS software and how their existing work could be supported by ICTs.

In this section, we first describe the location, people and infrastructure in the district. We then describe the organization and practice of health information flows in the district.

4.1   Location, People and Infrastructure

Xai-Xai district health office is located 15 kilometers from the provincial capital of Gaza, and has an area of 1749 square kilometers, with a population of 200.896 habitants. This health district comprise of 13 health units including 1 rural hospital, 1 health center and 11 health posts. The rural hospital and the health center which are located in the same geographical boundary serve a population of 74.357 inhabitants. A medical doctor, medical technicians, nurses and midwives staff both the hospital and the health center. However, these entities perform different activities relating to health care, and consequently they have different relations to the HIS. The health center is located in a compound, which consists of many buildings (Figure 2), each typically consisting of one room with a thatched roof (Figure 3), and associated with a particular health program or disease. For example, the three people from NEP sit in the same one-room building, as is the case with the staff responsible for ELAT/ELAL (Tuberculosis and Leprosy programs). There is another room that is the venue for conducting training programs and seminars for health technicians. This room is better equipped than the other rooms as it has a computer, a photocopy machine, a classroom, and a small library. This infrastructure has been donated by the Portuguese Co-operation and Save the Children, and during our stay there we often found this room to be securely locked.

Figure 2. Xai-Xai compound.   *Figure 3.* The room housing the NEP.

The health posts are located at a relatively large distance from the district office. At the health posts, we asked the patients how long it took them to reach the post and the replies ranged from a half hour to two-hour walk. There was no vehicle available at the health post, and during times of emergency (for example, child birth), a car was borrowed from someone in the community or a public transport (called "shapa") was used. The health posts consist of one or two small rooms, and sometimes have facilities for conducting deliveries, staffed by one trained medical agent and/or nurse. The health posts serve as the first point of entry of the patient into the health system. A card is made out for the patient, which is then supposed to serve as covering the history of the patient, for example starting from the detection of pregnancy to antenatal checkups to delivery and the various immunization activities that are expected to culminate in the child being "fully immunized". These cards are not maintained by the health posts but are given to the patients. Often these cards are misplaced, and a new card is then prepared, and the patient history "reconstructed".

4.2   Organization and Flows of Health Information

Within the hierarchal structure of the district office, the group of three people that constitute the NEP are in charge of the collection, aggregation, and analysis of all the health data from all the health units of the entire district, and its transmission to the provincial level. The team is composed of the chief of HIS (also the chief of NEP), and the persons responsible for SMI and PAV.

In addition to the monthly data sent by health units, the NEP also receives the weekly epidemiological bulletin (BES) which is the basis of the weekly surveillance system for a number of important infectious diseases.

Health data come from the health units and other sources, for example there are seven APEs in Xai-Xai district that send data directly to the NEP. APEs record their health care activities (for example, outpatients seen) on a form that is created specially for this specific district. There are also twenty six Matronas (traditional midwives) in the district who send in separate data documents to the NEP staff. The data first come to the head of the NEP who then distributes the forms to the staff responsible for the PAV and SMI programs respectively. These different people constitute a network of flows and are jointly responsible for compiling the monthly report to be sent from the district to the province.

On an average, health personnel meet more then 100 patients a day leaving them without much time and energy to perform administrative tasks relating to health information. They are also constrained by the fact that they often have to travel to provide supervision to other health units within the district. During the course of our field research, we followed the person

responsible for the SMI program. We found that in the morning she met many patients, basically women coming for antenatal observation, delivery, post-natal and family planning issues. Each interaction with a patient was a rather personal and customized one, taking 5-10 minutes on an average. After working with the patients, she went to the NEP room to fill forms about what she did, for example how many patients she met and the number of medicines and condoms distributed during the day. Often, the actual numbers were forgotten, and what was documented was what she thought she remembered. As a result, there were mismatches between patients actually seen and medicines distributed. These "incorrect" numbers became part of the artifacts as they were summarized in the forms sent on to the province. As a result of the "flows", given the lack of any form of quality control and supervision, these data became part of the official archives.

We found communication practices between people responsible for data collection relating to the various programs taking place in a very informal and improvised manner. Being located in the same room, many steps of the data flows took place by people going across to the other table and taking a form or leaving one on the table if the other person was not around. The servants who carried the data from the health posts to the DDS would slip the reports under the door of the office if the door to the NEP room was locked. These reports would often lie unseen on people's tables because they were too busy or not available. As a result, although the BES was supposed to be a weekly report, it was often compiled and sent with two weeks delay or more. The tables of the staff of the NEP were littered with various forms, unstapled and stapled, both from the previous and current months. Forms were often mixed up, misplaced, or just not tended to. When asked why the forms were lying in such a mixed up state, one of the NEP team members responded "there are not enough folders available to neatly group forms by months or diseases". However, the close proximity of three NEP members and the camaraderie and good will that seemed to exist helped to ensure that despite the tremendous work pressure, somehow the monthly routines around data collection and its transmission were performed. Though the NEP staff told us that due to time constraints it was not possible for them to perform any systematic analysis of data, we found many tables and graphs pinned to the walls. This display could be seen as a reflection of "orders being obeyed", since the province had instructed the districts to make greater use of graphs and analysis.

Also interesting were the different levels of trust ascribed to the data by the NEP staff depending on whether the forms were carried by the servants or by the medical nurse. Needless to say, forms carried by the servant were trusted less than if carried by the nurse. The carrier of the data influenced the perceived quality of data since clarification over discrepancies in data could be provided by the nurse and not so by the servant.

The health information flows in the NEP were rather convoluted. Data would come to the head of the health information system in a stapled bunch. He/she would unstaple them and pass the respective forms to concerned individuals who needed to fill in and return them back to the head of NEP. The completed forms would then be restapled and sent to the DDS Director who was then responsible for signing them and transmitting them to the province. We could not detect any formal system of quality control and supervision, and the signing appeared to be a routine formality. Though the reports were supposed to be sent to the province on a monthly basis, there were often significant delays in their transmission. Contributing to these delays was the distance between the district and province, poor transportation means, and the fact that the district would try to combine the sending of reports with other tasks that needed to be done in the province, for example, the collection of medicines. In cases of delays, rarely did the province take action and demand that the reports be sent on time the next time around. As a result, the poor communication between the different levels of the health network within the district, contributed to the poor quality and untimely flows of health information.

At the provincial level, the person responsible for statistics entered the paper-based forms received from the district into a computer. The person entering the data has completed 10 years of education (básico) and is currently studying for the pré-universitário qualifications (12 years), but lacks any statistical and medical training. The lack of formal advanced training has potentially important implications for ensuring the quality of health information, and the level of statistical analysis that could be carried out. After entering the data into the computer database, print-outs were taken and the paper forms were circulated to the province staff responsible for different programs. These people performed their individual analyses, and the Head of provincial statistics also conducted a similar analysis. Reports were sent to the central level by fax or were carried in person in paper form or in floppy disks. We were told that often faxes were sent to the wrong person in MISAU and not the person responsible for national health statistics. A phone call would then come from MISAU a few weeks later to remind the province that the data were not received, leading it to be re-sent more carefully. Similar stories were also told when reports were sent in person; normally the reports were sent with any person going towards Maputo on other errands (personal or official). This person would often leave the floppy disk or paper forms with anyone in MISAU, since he would be scared to go directly to the Director; sending the reports in person did not necessarily imply that the data would reach the concerned person in MISAU on time. When received by floppy disk, sometimes the data would be entered into the MISAU database successfully, but sometimes the disk was just put away in the cupboard and sometimes the floppy disk were unusable. The

effect of these inconsistencies was clearly evident when we analyzed the national database and detected tremendous gaps in the data. For example, sometimes 4 or 5 months in a particular year did not have data, and other times many facilities had blank entries against their name.

In addition to the monthly reports, both the district and the province are responsible for producing three-, six-, nine-monthly and annual reports describing the health status of the district and province during these time periods, and comparing it with corresponding periods of the previous year. This analysis was also seen to have many inconsistencies and gaps.

5   DISCUSSION AND CONCLUSIONS

Through the case discussion and analysis, we have analyzed the mutual linkages between communication practices and health information flows within and across the four different levels of the health administrative structure (community, district, province and national levels). In general, communication practices were seen to be informal, locally specific, and taking place in an improvised manner. For example, forms were slipped under the door with no real accountability on who left the forms and when. Who carried the data influenced the perceptions of data quality, and who carried it was less by design and more based on the chance event of who was traveling when in a particular direction. While these local practices influenced the overall quality, timeliness and usage of formal data, at another and more informal level, to outsiders like us, the work seemed to be going on with a degree of harmony that obscured the seeming chaos within. The routines of the bureaucracy were being followed within "acceptable" constraints of timeliness, quality and inconsistencies. In general, it seemed to be accepted that data collection was seen as a task that had to be performed primarily to meet the needs of the bureaucracy, and was thus subservient to the primary and mammoth task of providing health care to vast numbers of people with very limited resources.

The sense of apparent harmony within the DDS in Xai-Xai could suggest that the existing networks built around these local communication practices are reasonably well aligned and robust, tied up with certain of the existing inscriptions embedded in the national HIS. These inscriptions are embedded in the "node" of the NEP in Xai-Xai based on social networks of the surrounding health information flows which are deep rooted in the local identity culture expressed in ways of working. It is this "deep rootedness" which comes into tensions with new ICT-based initiatives and management methods that require certain systematization of processes (for example, how and where data are to be filled or not) and the use of rules for the aggregation, analysis and transmission of data.

The ongoing attempts to introduce HISP in Xai Xai have made little impact to date. The HISP facilitators installed the software in the district computer and provided training to potential users in 2001. However, after many months when we went back in 2002, we discovered that the software had never been opened after that training session. The question that arises then is, "why was that the case?" One of the reasons could be the inappropriate facilitation support provided by the HISP trainers who had not followed up or returned to the site for many months. But is that the only reason? We tried to rectify this issue of inadequate support by being based in the district for two full weeks to ensure more active and continuous facilitation. During these two weeks we provided the NEP staff with training on how to use the software, enter their routine data and perform some basic analysis. We also educated them about the aims and objectives of HISP. The basic principle of HISP is to work with health personnel who are responsible for health data to encourage their capabilities to use the collected data as meaningful information in providing PHC.

Despite their apparent enthusiasm and interest to learn something novel, the NEP staff could not translate their interests and routines to those demanded by the HISP approach and software. For example, they could not find the time to dedicate to learning the DHIS software and to practice data entry. The existing system of communication that was based on co-location and face-to-face interaction in the NEP room was disrupted by their extended presence in the computer room that was a few buildings away. During the course of our training efforts, we found that the NEP staff were constantly being called by the hospital staff to do other jobs, for example to a patient or go to the pharmacy and collect more condoms. The whole exercise of HISP and the training was seen as something that was being added on and burdening them beyond what they already needed to do. They thus found it difficult to understand the meaning of ICT in their everyday work and ongoing systems of communication and work structures. HISP, in its present form, thus represents a network that is only partially aligned, with the interests of the local actors only partially translated into that of the system. Many reasons have been pointed out to contribute to this state including existing communication patterns, infrastructure constraints, educational levels, and a culture that does not yet value the "efficient use of information". However, our analysis suggests that there is a counter network in Xai-Xai deeply rooted in local communication practices and social network.

The existing experiences thus raise the question, how might such "counter networks" be extended to address these ongoing challenges? At a more fundamental level are these counter networks desirable? Taken from a normative perspective, we can argue that these counter networks are desirable as a number of existing challenges around the health care system

could be addressed with more effective information management. A simple example could be that a "proper" report on drug consumption in the district could help the province authorities to send the right medicines to the correct place and in a timely manner. As one doctor told us, better information can at least help them to make better claims of what they need, and how currently these needs are not being met. Whether the province authorities will act on the information they receive is another question, but at least the availability of relevant information is an important starting point for advocacy.

If we agree that counter networks are a desirable and effective means of trying to make the situation of previously excluded groups and regions visible over the network, and with it create the potential of appropriate action (for example, the better deployment of resources), the challenging question concerns how can they be further constructed? We have argued that a starting point and fundamental step in this process is to understand in depth the existing communication practices and how these are intricately tied up with the flows of health information. Such an understanding can help develop closer insights into how these practices can both support and be supported by initiatives like HISP. Training and facilitation efforts need to take into account broader infrastructure constraints, the skill level of people, the time and timing of when and how training is conducted, and the personal motivations of the staff. For example, our training efforts could have been more effective if the computer was placed in the NEP room rather than the present situation where it is in a different building. This sensitive placement of the computer would lead to smaller disruptions in the existing work practices. Communication practices are intricately tied up with deeper questions of identity of the health staff, and understanding these relationships is crucial for developing context-sensitive approaches for implementation of computer-based information systems. Indeed, to create counter networks linking the marginalized and excluded to the network society (following Castells) requires first to recognize the existence of counter network in the local context. These are the issues which we will continue to pursue in the future stages of our empirical and theoretical explorations.

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